



Nortel IVR 2.5/S

Planning and Engineering Guide

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August 1997

NORTEL
NORTHERN TELECOM

Nortel IVR 2.5/S

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Chapter 1: Introduction

Overview

Nortel IVR 2.5/S combines one or two Multimedia Resource Servers (MRS) with a general purpose Application Processor (AP) to provide a versatile application development and/or run-time environment. The MRS provides the information processing environment (for example, voice, fax, voice-recognition, text-to-speech) and the network interfaces. The AP provides the environment for the development of IVR applications and the management/control of the IVR product.

Folded and unfolded platforms of Nortel IVR 2.5/S are available to Nortel customers. The unfolded Nortel IVR 2.5/S platform is comprised of the following hardware: MRS/Rack or MRS/Tower, and AP. The folded platform combines the MRS and AP functionality in one physical hardware platform, referred to as the MRS/AP.

The NGen 700t (ALTServer/Magellan) is used as the AP and MRS/AP hardware platform in the Nortel IVR products. A single AP can support up to two MRSs.

The MRS/Tower and MRS/Rack are the two available MRS platforms.

Purpose

The purpose of this document is to specify the valid configurations, the supported limits, and the system performance and response-time characteristics of Nortel IVR 2.5/S. This document also provides a set of rules and guidelines for the configuration of the Nortel IVR 2.5/S product.

Chapter 2: System security

Nortel IVR 2.5/S software is controlled by a keylock device which is attached to the parallel port on the AP and MRS/AP. The system periodically reads the keylock in order to determine if the installed packages on the system are licensed. The keylock controls the following features:

- SCO Operating System
- SCO Development System
- XPM (Prompt Manager)
- Ingres Database Option
- Oracle Database Option
- Informix Database Option
- Sybase Database Option

Chapter 3: System hardware

Application Processor (AP)

AP hardware components

AP base hardware components

All Nortel IVR 2.5/S APs include the following hardware:

- onboard Super VGA Video Controller with 1 Mbyte Video DRAM and maximum resolution of 1024 by 768 with 256 colors
- PS/2-style keyboard and mouse connectors
- 8 bus master slot (3 PCI/ 5 EISA and 1 hybrid) system baseboard
- onboard Adaptec AIC-7870 twin channel PCI SCSI-2 controller
- Pentium 75, 100, or 133 MHz CPU Module
- one parallel port and two 9-pin serial ports
- 32 Mbyte base system memory, upgradable to 64 and 96 Mbyte
- 256 kbyte of cache
- 2.5 Gbyte SCSI 1/2 inch cartridge tape drive
- 3.5 inch Floppy Drive
- 1 Gbyte fast-wide SCSI-2 Hard Drive
- 525 W AC power supply
- Keylock
- Ethernet or Token Ring LAN card
- monitor (14" or 17")

- mouse

AP optional hardware components

The following is a list of optional hardware components for the AP:

- host connectivity card (3270, 5250, VT100)
- uninterrupted power supply (UPS)
- memory upgrade
- additional hard disks

Multimedia Resource Server (MRS)

Multimedia Resource Servers (MRS) are intelligent voice processing peripherals providing call and speech processing as well as voice and fax storage. Interfacing to either CO- or CPE-based telephone switches, these units answer calls and process and store speech and facsimile information.

The MRS supports a variety of network and voice processing interfaces and corresponding resource modules such as speech recognition, text-to-speech, and fax options which are connected via the Dialogic PCM Expansion Bus (PEB). This is a time-division multiplexed digital bus that allows sharing of resources such as fax, speech recognition and text-to-speech, making those resources available to all of the ports in the system on a time-sharing basis. Therefore, a dedicated one-to-one relationship of resources to ports is not necessary.

Note: Unlike Nortel IVR 2.01/S, Nortel IVR 2.5/S supports resource sharing with Dialogic D/41ESC and Aculab E1 configurations.

The MRS is positioned between the application processor and the PSTN to manage application software requests for internal voice processing and the access to the telephone network for in-bound and out-bound calls.

Visual indicators mounted on the MRS display panel (and an external interface connected to the MRS alarm port) provide real-time status information to the system administrator about the MRS power status, trunk activity, disk activity and system alarms.

MRS hardware components

MRS base hardware components

All Nortel IVR 2.5/S MRSs include the following hardware:

- a rack chassis (AC or DC powered)
- a tower chassis
- a 20 slot ISA passive backplane for the MRS/Rack
- an 18 or 20 slot ISA passive backplane for the MRS/Tower
- 80486 DX2/66 CPU module
- SCSI hard disk controller
- display controller
- serial I/O controller
- 32 Mbyte of memory
- Ethernet or Token Ring LAN card
- modem

MRS optional hardware components

The following is a list of optional hardware components for the MRS:

- Loopstart, T1, or E1 telephony interfaces; one telephony interface is a required option for the MRS
- text-to-speech
- continuous speech recognition
- discrete speech recognition
- fax
- uninterrupted power supply (UPS)
- redundant DC power supply (for MRS DC Rack only)
- audio interface unit
- MRS cabinet (for multiple MRSs)
- additional hard disks

- external tape drive

MRS/AP

The MRS/AP combines application and voice processing resources into one powerful system. The MRS/AP uses the AP's base hardware components and the following optional hardware components:

- Loopstart, T1, and E1 telephony interfaces; one telephony interface is a required option for the MRS/AP
- text-to-speech
- continuous speech recognition
- discrete speech recognition
- fax
- uninterrupted power supply (UPS)
- audio interface unit
- additional hard disks
- host connectivity card (3270, 5250, VT100)
- memory upgrade

Network connection between the AP and MRS

The supported network connection between the AP and the MRS is either Ethernet or Token Ring.

Peripherals

LAN connectivity cards on an AP or MRS/AP

One of the following LAN cards is a required option on the AP or MRS/AP:

- PCI Ethernet Card (ZNYX)

Provides connectivity to Thicknet, Thinnet (coax) and 10Base-T (twisted pair) network types. This card is used in the AP and MRS/AP only, and connects them to an Ethernet LAN.

- ISA Token Ring Network Interface Card (Madge 16/4)

Provides connectivity to both Type 1 (shielded twisted pair) and Type 3 (unshielded twisted pair) network types. The interface card is fully software configurable and supports both 4 and 16 Mbit/s Token Ring transfer rates.

LAN connectivity cards on an MRS Tower or Rack

One of the following LAN cards is a required option on the MRS:

- ISA Ethernet card (SMC EtherCard Elite 16C)

Provides connectivity for twisted pair, AUI or coaxial wiring. This card is used in the MRS/Tower and the MRS/Rack.

- ISA Token Ring Network Interface Card (Madge Smart AT Plus 16/4)

Hardware component description for the AP

Magellan chassis

The 29 inch high chassis (MAG5000) houses eight I/O expansion slots, eleven peripheral bays, and a 525 W auto-ranging power supply. The chassis is fabricated using electro-galvanized (EG) metal to minimize EMI/RFI.

The side panel can be easily removed by removing two thumbscrews on the side panel. This provides easy access to the interior system baseboard, processor module(s), memory module(s) and any add-in cards. A side cover lock loop is available to secure the side panel.

A front door opens to access the six hot-swap drive array for easy replacement of the SCSI-2 hard drives.

The MAG5000 server chassis is designed to house either the 15 inch or 12 inch system baseboard.

The six internal 3.5 inch full-height bays provide over 54 Gbyte of hard disk expansion. Nortel IVR 2.5/S supports up to four 1 Gbyte hard disks on the AP and up to two 1 Gbyte hard disks on the MRS/AP. The six bays have been designed to allow easy setup of Redundant Array of SCA-compatible Backplane. Four external 5.25 inch half-height bays are available for backup or removable media devices. The standard MAG5000 configuration incorporates a 3.5 inch Teac FD235HF 217-U floppy disk drive, which supports both 720 kbyte and 1.44 Mbyte media, for a total of five external drive bays.

The front cover on the MAG5000 Premium server provides access to the four external peripheral bays, the 3.5 inch floppy drive, system reset switch, and power on/off switch. Three LEDs display system activity: a yellow LED for IDE or SCSI hard disk activity, a red LED for a SCSI failure, and a green LED for system power-on. The MAG5000 front panel is protected by a mechanically lockable front door. Unique keys are used for additional security. A key from Intel is available for both the front panel and side chassis locks.

The Delta 525 auto-ranging power supply automatically switches between 110 V and 220 V AC inputs, supporting use in all parts of the world requiring a switch change. The power supply has three DC peripheral connectors for the accessible drive bays, two mini-output connectors for use with 3.5 inch floppy drives, and one TTL output connector for use with 5.25 inch peripherals or a 3.5 inch hard drive. A separate connector provides power directly to the SCSI-2 SCA Backplane.

The power supply fan transfers air at a rate of 250-300 linear feet/minute (35 cfm) from the exhaust port to cool the baseboard and peripherals. In order to provide additional cooling with minimum noise, a variable speed fan (maximum 100 cfm) also helps cool the chassis interior. The fan speed is determined by the air temperature and the number of hard drives in the bottom peripheral bays. This fan is monitored for a drop in RPMs based on an internal temperature increase. If necessary, the fan can be "hot-swapped" without bringing down the server system. The MAG5000 is pressurized internally to allow needed airflow across all drive bays. Operating with the side cover or processor compartment panel removed disrupts the airflow and will affect long term reliability.

The MAG5000 Premium Server system is designed for easy installation, upgradability and maintenance of the disk, processor, memory and I/O subsystems. The SCSI-2 SCA Backplane minimizes cabling for power and control from disk controllers and the power supply to the drive bays. It also contains a SCSI-2 port for any external SCSI drives. The Adaptec AIC-7870 SCSI-2 controller integrated on the system baseboard eliminates the need to install SCSI controllers in the expansion slots.

The Altair motherboard (AP)

Nortel IVR 2.5/S uses an Intel ALTServer System. In contrast with the Xpress modular architecture, ALTServer offers a “flat” design with the processor and memory subsystems residing on the main baseboard. The ALTServer design uses members of the Intel 82430 Neptune PCI set to provide high performance and a highly integrated system at multiple price/performance levels. Two Zero Insertion Force (ZIF) sockets for Pentium processors provide CPU scalability.

Note: Nortel IVR 2.5/S supports only a single CPU.

Additional simple and cost-effective performance upgrades are available through a variety of plug-in cache module options. The ALTServer's expansion capabilities meet the needs of file and application servers for high performance I/O by providing a combination of PCI local bus and EISA connectors. The baseboard offers two dedicated PCI slots, five dedicated EISA slots, and one shared PCI/EISA slot. The PCI local bus offers burst transfers at 133 Mbyte per second and is a proven high-speed solution on the desktop. This combination of PCI and EISA expansion offers continuing support for existing special function EISA add-in boards. All of the add-in slots are available to the user because the high-performance PCI fast SCSI-2 interface and a PCI graphics controller are integrated on the baseboard. A number of security, reliability, and management features also have been incorporated into the ALTServer's design to meet vital server needs.

Pentium processors

The ALTServer baseboard is designed to operate with 75 MHz, 90 MHz, 100 MHz, 120 MHz, 133 MHz or 166 MHz Pentium processors and is shipped with a single processor installed in the Zero Insertion Force (ZIF) socket. The Pentium processor has an internal speed of 75, 90, 100, 120, 133, or 166 MHz and an external speed of 50, 60, or 66 MHz respectively and is backward-compatible with the Intel 486 processor. The Pentium processor supports both read and write burst mode bus cycles and includes a 16 kbyte on-chip cache core (8 kbyte for code and 8 kbyte for data caches) employing a write-back policy. Also integrated into the Pentium processor is an advanced numeric coprocessor which significantly increases the speed of floating point operations, while maintaining backward compatibility with the i486DX math coprocessor and complying with ANSI/IEEE standard 754-1985. Based on 0.6 micron processes, the Pentium processor is powered by 3.3 volts and supports Intel's System Management Mode (SMM) power-management operation.

Note: Nortel IVR 2.5/S only supports the following Pentium CPUs: 75, 100, and 133 MHz.

Second level (L2) cache

To provide a cost effective solution using standard chip set components, the ALTServer offers an upgradable second-level cache using Integrated Device Technology (IDT) or Corsair cache devices. This provides five options and price performance points: no cache, 256 kbyte or 512 kbyte asynchronous cache, 256 kbyte or 512 kbyte burst synchronous cache.

Note: Nortel IVR 2.5/S only supports 256 kbyte of burst synchronous cache.

The performance of each option depends on many factors, such as operating system, number of processors, amount of system memory, and other variables. However, as a general rule, overall system performance increases with larger cache sizes. The use of a burst synchronous cache should provide even higher performance than the equivalent size asynchronous cache device.

The second level cache may be *Enabled* or *Disabled* using the BIOS Configuration Utility. When Enabled, the caching policy is always write-back mode to support the internal (L1) 16 kbyte cache of the Pentium processor. With a burst cache device installed, the processor read and write clock latencies are 3-1-1-1. With the asynchronous modules, the processor read latency is 4-2-2-2 and the write latency is 3-1-1-1.

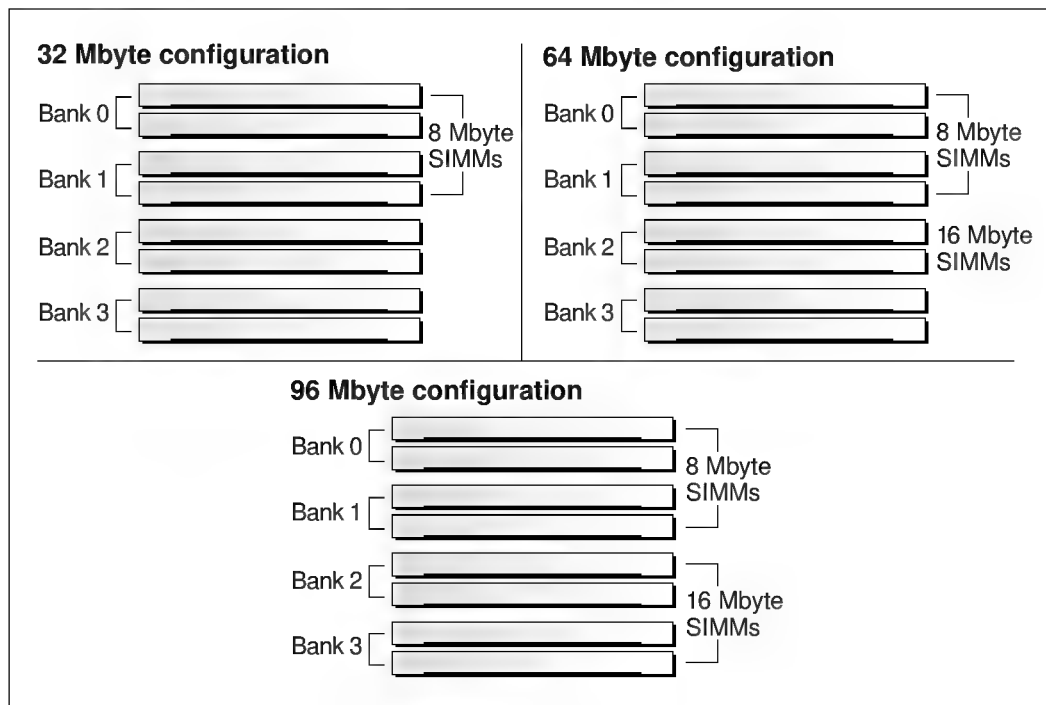
System memory

The main system memory is provided with eight 72-pin SIMM sockets for up to 256 Mbyte of memory expansion on the baseboard. Each socket can hold a 2, 4, 8, 16, or 32 Mbyte SIMM. The minimum memory size is 2 Mbyte and the maximum memory size, using eight 32 Mbyte SIMMs, is 256 Mbyte. Memory timing requires 70 ns fast page devices. Parity generation/checking is provided for each byte.

The eight SIMM sockets are arranged as four banks (Bank 0, 1, 2 and 3) with each bank consisting of two sockets and providing a 64-bit wide data path and 8 parity bits. The memory array is controlled by the Intel 8434NX PCMC and data buffering is provided by two Intel 82433NX Local Bus Extension devices. SIMMs in all banks must be of the same memory size and type. Any (or all) banks may be populated to provide the required system memory.

Note: Nortel IVR 2.5/S supports a minimum of 32 Mbyte and a maximum of 96 Mbyte of memory. Each of the first two banks is populated with 2x8 Mbyte SIMMs, while the last two banks can be populated with either 8 or 16 Mbyte SIMMs. Only the DRAM configurations shown in Figure 3-1 on page 3-10 are supported for Nortel IVR 2.5/S.

Figure 3-1: DRAM configurations



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Graphics subsystem

The SVGA subsystem is based on the Cirrus Logic 5430 PCI graphics controller. The Cirrus 5430 supports backward software compatibility with MDA, CGA, Hercules Graphics, EGA, and VGA graphics standards. The standard configuration includes 512 kbyte of graphics DRAM soldered on the ALTServer baseboard. Graphics memory can be upgraded to a total of 1 Mbyte by adding a 256 kbyte x 16 fast page mode 70 ns DRAM to the SOIC socket on the baseboard. The upgrade will allow higher display resolutions and performance. The display RAM is paged into 128 kbyte of RAM located between A0000H and BFFFFH.

Note: Standard Nortel IVR 2.5/S configuration includes 1 Mbyte of graphics memory.

Graphics resolutions and frequencies

The Cirrus 5430 video controller provides all of the standard IBM VGA modes. With 512 kbyte of video memory, the standard ALTServer goes beyond standard VGA support. The following tables show all supported video modes using the standard 512 kbyte of video memory, as well as with a user-installable upgrade to 1 Mbyte of video memory. The following tables show the standard and extended modes that the chip supports, including the number of colors and palette size (for example, 16 colors out of 256K colors), resolution, pixel frequency, and scan frequencies. All modes are supported with at least 512 kbyte of video memory unless otherwise specified.

Table 3-1: Video Controller supported Modes

Mode(s) [Hex]	Colors (number /palette size)	Resolution	Pixel freq. (MHz)	Horiz. freq. (KHz)	Vert. freq. (Hz)
0, 1	16/256 K	360 X 400	14	31.5	70
2, 3	16/256 K	720 X 400	28	31.5	70
4, 5	4/256 K	320 X 200	12.5	31.5	70
6	2/256 K	640 X 200	25	31.5	70
7	Mono	720 X 400	28	31.5	70
D	16/256 K	320 X 200	12.5	31.5	70
E	16/256 K	640 X 200	25	31.5	70
F	Mono	640 X 350	25	31.5	70
10	16/256 K	640 X 350	25	31.5	70
11	2/256 K	640 X 480	25	31.5	60
12	16/256 K	640 X 480	25	31.5	60
12+	16/256 K	640 X 480	31.5	37.5	75
13	256/256 K	320 X 200	12.5	31.5	70
14, 55	16/256 K	1056 X 400	41.5	31.5	70
54	16/256 K	1056 X 350	41.5	31.5	70
58, 6A	16/256 K	800 X 600	40	37.8	60

3-12 System hardware

Mode(s) [Hex]	Colors (number /palette size)	Resolution	Pixel freq. (MHz)	Horiz. freq. (KHz)	Vert. freq. (Hz)
58, 6A	16/256 K	800 X 600	49.5	46.9	75
5C	256/256 K	800 X 600	36	35.2	56
5C	256/256 K	800 X 600	40	37.9	60
5C	256/256 K	800 X 600	49.5	46.9	75
5D	16/256 K (inter- laced)	1024 X 768	44.9	35.5	87
5D	16/256 K	1024 X 768	65	48.3	60
5D	16/256 K	1024 X 768	75	56	70
5D	16/256 K	1024 X 768	78.7	60	75
5F	256/256 K	640 X 480	25	31.5	60
5F	256/256 K	640 X 480	31.5	37.5	75
60*	256/256 K (inter- laced)	1024 X 768	44.9	35.5	87
60*	256/256 K	1024 X 768	65	48.3	60
60*	256/256 K	1024 X 768	75	56	70
60*	256/256 K	1024 X 768	78.7	60	75
64*	64 K	640 X 480	25	31.5	60
64*	64 K	640 X 480	31.5	37.5	75
65*	64 K	800 X 600	36	35.2	56
65*	64 K	800 X 600	40	37.8	60
65*	64 K	800 X 600	49.5	46.9	75
66*	32 K Direct/256 Mixed	640 X 480	25	31.5	60
66*	32 K Direct/256 Mixed	640 X 480	31.5	37.5	75

Mode(s) [Hex]	Colors (number /palette size)	Resolution	Pixel freq. (MHz)	Horiz. freq. (KHz)	Vert. freq. (Hz)
67*	32 K Direct/256 Mixed	800 X 600	40	37.8	60
67*	32 K Direct/256 Mixed	800 X 600	49.5	46.9	75
6C*	16/256 K (inter- laced)	1280 X 1024	75	48	87

* Requires 1 Mbyte video memory option

UPS

The UPS for the AP and the MRS/AP is APC's Smart-UPS 1000.

The power rating of the SU1000 UPS is 1000VA or 870 watts. Its input/output voltage is rated at 120 V, 60 Hz. Please note that a fully loaded Nortel IVR 2.5/S system excludes the SVGA monitor. The SU1000i is also supported for countries where the input/output voltage is rated at 220 V, 50 Hz.

The tables below show the typical battery backup run-time for the AP and MRS/AP.

Table 3-2: UPS Battery Run-Time for the AP and MRS/AP

Number of disks	Time (minutes)
1 Disk	73
2 Disks	68
3 Disks	63
4 Disks	58

Table 3-3: UPS Battery Run-Time for the MRS/AP

Number of disks	Number of ports	Time (minutes)
1 Disk	12	48
	24	42
	36	35
	48	30
2 Disks	12	35
	24	30
	36	27
	48	23

Monitors

17 inch Monitor

The 17 inch ViewSonic monitor will be used for development or run-time systems on the AP (or MRS/AP). It provides 1024 * 728 resolution with 256 colors. The dot pitch of the monitor is 0.27. The 17 inch ViewSonic monitor is strongly recommended for development systems.

14 inch Monitor

The 14 inch SAMPO Monitor will be used for a development or a run-time system on the AP (or MRS/AP). It provides 1024 * 728 resolution with 256 colors. The dot pitch of the monitor is 0.28.

Hard drive

Nortel IVR 2.5/S can use either a Quantum or a Seagate hard disk. The Quantum QM31080FB-SCA (Fast-Wide SCSI-2 single ended 16 bit) hard disk has an unformatted capacity of 1.2 Gbyte and a formatted capacity of 1.075 Gbyte.

The Seagate ST31055WC (Fast-Wide SCSI-2 single ended 16 bit) hard disk has an unformatted capacity of 1.2 Gbyte and a formatted capacity of 1.060 Gbyte.

Tape drive

The tape drive used in Nortel IVR 2.5/S (AP) is a 2.5 Gbyte Tandberg (SCSI-2).

Printer

The recommended printers for Nortel IVR 2.5/S are DEC LA75S Dot matrix printer and HP Laserjet 4M Plus.

Note: Printers are not supplied by Nortel.

Ethernet controller card for AP (or MRS/AP)

The ZYNX adaptors connect the Nortel IVR 2.5/S system to an Ethernet network wired with IEEE 802 standard 10BASE2 or 10BASE5 coaxial cable, or 10BASE-T twisted-pair cable. The card uses one 32-bit slot (PCI) and 16 byte of I/O space, starting at any 16-byte boundary from 200h to 3F0h.

Token Ring controller card for AP (or MRS/AP)

The Smart 16/4 AT Plus Ringnode provides a Token Ring network connection for the Nortel IVR 2.5/S system with the 8-bit or 16-bit Industry Standard Architecture (ISA) bus. The adapter supports both 4 and 16 Mbit/s network and uses UTP (Unshielded Twisted Pair) and STP (Shielded Twisted Pair) connections.

Maximum configuration flexibility is provided by a choice of bus master operation or 16-bit programmed I/O, with numerous IRQ and DMA options. This ensures the Smart 16/4 AT Plus ringnode is universally suited to workstation, gateway and workgroup server applications.

Host connectivity boards

Serial board for AP (or MRS/AP)

The DigiBoard PC/Xe board is a multichannel intelligent serial communications board for ISA computers. The heart of the PC/Xe board is an 80186 microprocessor and 64 kbyte of dual-ported RAM, which relieves the computer of the burden of managing the serial ports. The computer can transfer large blocks of data directly to the memory on the board, then move on to other tasks while the board sends the data out the serial port one character at a time. Similarly, the board receives input data and stores it in buffers in its dual-ported RAM, so the computer only needs to check periodically to see if data is available. The throughput of the card is maximum 115 kbit/s per port.

The dual-ported RAM is memory which is accessible for read and write operations by both the board and the computer. To the computer, the dual-ported RAM looks exactly like its own memory, and can be accessed by the same high speed memory referencing commands it uses for its internal memory. This means that a block of data that may take a number of seconds for the PC/Xe board to receive or transmit to the outside world can be transferred between the board and the computer in microseconds.

The dual-ported RAM is “mapped” into an unused area in the host computer’s memory address space (typically somewhere between 0C0000h and 0EFFFFh—the area traditionally reserved for expansion board BIOS ROMs and dual-ported memory). The PC/Xe board can be set via software so that the entire 64 kbyte is mapped into the computer’s memory, or just an 8 kbyte “window”. Using the 8 kbyte window allows the user to fit the board into a smaller space when it has to coexist with a number of other expansion boards, many of which also need memory address space in the 0C0000h-0EFFFFh area (the entire 64 kbyte is still used; it’s just divided into eight 8 kbyte segments which can be accessed by moving the window around).

To support more than 8 ports, the Digiboard PC/Xem (PC/16em, PC/32em) family of boards is used. This family of host adapter cards feature a 20 MHz IDT 3051 RISC processor, 256 kbyte dual-ported RAM, and it supports four Digi PORTS Modules for a maximum of 64 ports.

Note: Nortel IVR 2.5/S supports a maximum of 32 ports.

The Digi PortServer family is an advanced terminal server that allows a cluster of high-speed serial ports to connect to an existing TCP/IP Ethernet network. This allows serial devices such as terminals, modems, and printers to attach anywhere along an Ethernet cable without the high cost of an additional PC as a network interface. The Digi PortServer has an 8 and 16-port configuration and provides 57.6 kbit/s performance through each of its EIA-232 ports.

SDLC card

The Arnet (Express) SYNC/570 is a high-performance expansion board for ISA computers. The SYNC/570 has two synchronous/asynchronous serial ports. The Hitachi HD64570 Serial Communications Adapter (SCA) provides a highly-integrated advanced communications subsystem for the card. It further maximizes synchronous communications performance by using protocol-specific features to minimize driver overhead. The onboard memory of SYNC/570 is directly addressable by both the system and the SCA's DMA. Program-initiated DMA transfers operate at DMA/memory speed independently of other system activity. The two ports of the SYNC/570 each have a high density DB-15 connector to connect any device with an EIA-232-D interface to the computer. The board operates at line speeds from 4800 baud to over 115 kbit/s.

Madge card (Token-Ring)

Same as "Token Ring controller card for AP (or MRS/AP)" on page 3-15.

Hardware component description of MRS/AP

The MRS/AP uses the same base hardware platform as the AP. Hardware that is optional for the AP is also optional for the MRS/AP. Telephony hardware used by the MRS is also used by the MRS/AP. The modem and AIU used by the MRS are also used by the MRS/AP.

Hardware component description of MRS

Hard drive

The hard drive used on the MRS is the Seagate ST31051N, which has an unformatted capacity of 1.26 Gbyte and a formatted capacity of 1.06 Gbyte.

External tape drive

The external tape drive used on the MRS will be a 2.5 Gbyte Tandberg.

Modem

A 9600, 28.8 or 33.6 kbit/s USRobotics modem is used for remote support on the MRS or MRS/AP. The 14.4 kbit/s USRobotics modem is only supported on the MRS/AP. The modem will be connected to the COM2 port on the MRS/AP and to the COM1 port on the MRS.

Ethernet controller card for MRS

The SMC's EtherCard Elite16C Ultra Adapter provides Nortel IVR 2.5/S an Ethernet network connection with IEEE 802 standard 10BASE2 or 10BASE5 coaxial cable, or 10BASE-T twisted-pair cable. The card uses a 8-bit or 16-bit slot (EISA) and 16 kbyte of contiguous available memory space in the region C000 to EFFF.

Token Ring controller card for MRS

Smart 16/4 AT Plus Ringnode (see "Token Ring controller card for AP (or MRS/AP)" on page 3-15).

Dialogic telephony boards

There are two types of boards from Dialogic, low density and high density. The D/81A, D/121B, D/320SC, LSI/80, and LSI/120 boards are considered low density cards. The D/240SC-T1, and D/41ESC cards are considered high density cards. The high density boards combine the voice processing and network interface onto a single board to provide a high port density per slot. Systems using low density cards require separate voice processing and network interface boards, and, as a result, they use more slots.

Dialogic low density boards

D/81A 8-Port voice processing board

The D/81A board provides call processing for 8 voice channels in a single ISA slot. Multiple D/81A boards can be installed in a single PC chassis enabling port expansion. The D/81A board is PEB ready. The D/81A board is used in conjunction with the LSI/80 telco interface card.

D/121B 12-Port voice processing board

The D/121B board provides call processing for 12 voice channels in a single ISA slot. Multiple D/121B boards can be installed in a single PC chassis enabling system expansion. The D/121B board is PEB ready. The D/121B board is used in conjunction with the LSI/120 telco interface card.

D/320SC 32-Port voice processing board

The D/320SC board provides call processing for up to 32 voice or data channels in a single ISA slot and is based upon Signal Computing System Architecture (SCSA). SCSA provides features such as distributed switching, logical addressing, and location-independent resource management. The D/320SC provides the flexibility to support both SCbus-based applications or existing PEB-based applications. The D/320SC card is used in conjunction with the Aculab E1 telco interface card.

Dialogic network interface boards

LSI/80 Loopstart interface board

The LSI/80 Loopstart interface board connects 8 analog telephone lines to PEB-based computer telephony resources. It incorporates industry-standard PEB architecture for sharing of facsimile, speech recognition and text-to-speech resources among call processing ports and for compatibility with existing PEB-based applications. Multiple LSI/80 boards can be installed in a single PC chassis, enabling system capacity expansion. The LSI/80 board is an AT form factor board with an 8-bit bus connector installable in either an 8-bit XT or 16 bit AT expansion slot.

LSI/120 Loopstart interface board

The LSI/120 Loopstart interface board connects 12 analog telephone lines to PEB-based computer telephony resources. It incorporates industry-standard PEB architecture for sharing of facsimile, speech recognition and text-to-speech resources among call processing ports and for compatibility with existing PEB-based applications. Multiple LSI/120 boards can be installed in a single PC chassis enabling system capacity expansion. The LSI/120 board is an AT form factor board with an 8-bit bus connector installable in either an 8-bit XT or 16-bit AT expansion slot.

Dialogic high density boards**D/41ESC World Card 4-Port voice processing board & Loopstart interface board**

The D/41ESC World Card provides four telephone line interface circuits for direct connection to analog loop-start lines, as well as four voice processing channels. Multiple World Cards can be installed in a single PC chassis enabling system expansion. The D/41ESC card is both PEB and SCbus ready.

D/240SC-T1 24-Port voice processing & T1 board

The D/240SC-T1 board, as a member of the DIALOG/HD High Density family of products, is based upon Signal Computing System Architecture (SCSA). SCSA provides features such as distributed switching, logical addressing, and location-independent resource management. DIALOG/HD products provide the flexibility to support both SCbus-based applications or existing PEB-based applications. The board provides 24 digital telco ports and 24 voice processing ports.

Dialogic speech recognition board

With the VRP board, you can create applications that allow hands-free speed dialing from cellular car phones, hands-free voice mail, and dialing of spoken numbers or names. Complicated numeric menu structures can be reduced to a small set of user-friendly spoken commands. The VRP board is an AT form factor board that installs in a 16-bit (ISA) expansion slot. The Dialogic VR/160 board is comprised of a Voice Recognition Platform (VRP) baseboard and one to four Voice Recognition Module (VRM/40) daughterboards for discrete word recognition or VRM/2C daughterboards for continuous word recognition. Up to four VRM/40 or VRM/2C boards can be fitted on the VRP. Each VRM/40 provides four discrete speech recognition ports. Each VRM/2C provides two continuous speech recognition ports.

Antares Text-to-Speech platform

Antares is a stand-alone open DSP (Digital Signal Processor) platform developed for high-density telecommunication applications. It is a DSP expansion board based on the standard Signal Computing System Architecture (SCSA). SCSA enables unified call processing and provides features such as distributed switching, logical addressing, and location independent resource management. Antares boards provide the flexibility to support both SCSA-based applications or existing PEB-based applications. The Antares board is a general purpose DSP platform that is typically used for speech recognition or text-to-speech applications. It is used by Nortel IVR 2.5/S for text-to-speech only.

Aculab E1 interface board

The Aculab MVIP/PEB Digital (ISDN) Access Card (Rev 4) supports up to 60 speech or data calls over Primary Rate ISDN or private networks. There are two versions available: 75 ohm with 60 lines, and 75 ohm with 30 lines. Connection is also possible to digital PBXs via DPNSS or to E1 type leased lines. The double E1 port card (60 lines) can have a different signaling protocol on each port and can also be utilized in a “drop and insert” configuration. The incoming lines can be arbitrarily switched to any of the timeslots available on the PCM buses which include the VMIP bus (256 timeslots) and the two PEB buses (2 x 32 timeslots). The Aculab E1 card supports CAS (Channel Associated Signaling), and enhanced DPNSS protocols. A daughterboard for the Aculab card is required in order to support the CAS protocols.

Brooktrout fax board

The TR114 series fax board (Rev 1 and 2, 1 Mbyte memory) offers two, four or eight fax ports in a single ISA slot. The TR114 series support:

- 14.4 kbit/s transmission
- MMR compression
- Error correction mode
- ASCII, TIFF and PCX file conversion and combination on-the-fly for integration with digital network interfaces or resources from other vendors.

UPS

The UPS for the MRS/Tower or the AC MRS/Rackmount is APC's Smart UPS 700.

The Nortel IVR 2.5/S MRS will use APC Smart-UPS 700 for its power backup in case of power failures. Its input/output voltage is rated at 120 V, 60 Hz. The smart UPS will shut down the MRS/Tower or MRS/Rack system automatically by sending commands via a serial connection. The SU700i is also supported in countries where the input/output voltage is rated at 220 V, 50 Hz.

The table below shows the typical backup run time for the MRS/Rack and MRS/Tower systems.

Table 3-4: UPS Battery Run-Time for the MRS/Rack/Tower

Number of disks	Number of ports	Time (minutes)
1 Disk	48	40
	36	45
	24	52
	12	58
2 Disks	48	33
	36	37
	24	40
	12	45
3 Disks	48	26
	36	28
	24	32
	12	36

Audio Interface Device/Prompt Transfer Tools

The Skutch AS-4 is the optional audio interface device provided for Nortel IVR 2.5/S. Documentation for the Skutch AS-4 and other prompt transfer tools can be found in the *Prompt Transfer Tools* (P0873435) manual.

Hardware part numbers and MTBF values

AP and MRS/AP hardware part numbers and MTBF values

Table 3-5: AP and MRS/AP component list

Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
Altair Motherboard/ Magellan Tower Chassis (A0639230)	It includes Pentium P5-75 and 8 slots (5 EISA, 2 PCI and 1 Combo) with AIC-7870 SCSI and IDE controller, 16 Mbyte DRAM, and six open SIMM sockets, 3.5-inch floppy drive, 525 watt power supply, 256 kbyte of Cache and in board 0.5 Mbyte Video Driver.	MG1F75A2M16 (NGen 700t-75)	73
Altair Motherboard/ Magellan Tower Chassis (A0639231)	It includes Pentium P5-100 and 8 slots (5 EISA, 2 PCI and 1 Combo) with AIC-7870 SCSI and IDE controller, 32 Mbyte DRAM, and four open SIMM sockets, 3.5-inch floppy drive, 525 watt power supply, 256 kbyte of Cache and in board 0.5 Mbyte Video Driver.	MG1F100A2M16 (NGen 700t-100)	73
Altair Motherboard/ Magellan Tower Chassis (A0666774)	It includes Pentium P5-133 and 8 slots (5 EISA, 2 PCI and 1 Combo) with AIC-7870 SCSI and IDE controller, 32 Mbyte DRAM, and four open SIMM sockets, 3.5-inch floppy drive, 525 watt power supply, 256 kbyte of Cache and in board 0.5 Mbyte Video Driver.	MG5F133A2M1 6B (NGen 700t- 133)	73
DRAM (A0639617)	16 Mbyte DRAM SIMM with Parity	MT12D436M-7	2034
DRAM (A0639569)	8 Mbyte DRAM SIMM with Parity	MT18D236M-7	1349

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Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
Video DRAM (A0639513)	Video DRAM 512 kbyte	RAM512KVID	
Secondary Cache Memory (A0639530)	Asynchronous 256 kbyte	IDT7MP6189-15	
SVGA Monitor (A0663897) (A0663896)	17" Non-interlace .27mm pitch	17GS	30
	14" Non-interlace .28mm pitch	KM-400	30
Hard Drive (A0639372)	1 Gbyte Hard Disk	QM31080FB-SCA	800
Hard Drive (A0657053)	1 Gbyte Hard Disk	ST31055WC	800
Floppy Drive (A0652239)	Floppy Drive, 3.5"	FD-235HF	80
Tape drive (A0622896)	2.5 Gbyte Tape Drive	TDC4220	20
Tape Drive Cleaning Kit (A0633585)	Tape Drive Cleaning Kit	TDC4220-8962	N/A
Backup Tape (A0630697)	Magnus 2.5 Gbyte Backup Tape		N/A
Mouse (A0663899)	3 button PS/2 type mouse	911313L100	150
Keyboard (A0663898)	Keyboard	RT-6655T	40

Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
UPS (A0656287)	Smart UPS (1000VA, 120V)	SU1000	35
UPS (A0655449)	Smart UPS (1000VA, 220V)	SU1000i	35
UPS (A0626335)	APC PowerChute Plus UPS SW for AP or MRS/AP	AP9004	
Printer (Not Supplied by NT)	DEC Dot Matrix printer	DECLA75S	
NORTEL Logo (No Part Number)	NORTEL logo for front Panel	No OEM Part Number	
Ethernet Card (A0663894)	PCI Combo Ethernet	ZX312B	100
Token Ring Controller Card (A0667574)	ISA Smart 16/4 AT Plus Ringnode Token Ring Card	052-030-08UY	138
AP Security Key (A0658655)	Software security key	17-840031-00	

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Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
Host Connectivity boards (A0639192)	VT100 Communications Board (8 ports), cable, and breakout box	HCOM-SC8- VT100	247
(A0639207)	VT100 Communications Board (16 ports), cable, and breakout box	HCOM-SC16- VT100	247
(A0639209)	VT100 Communications Board (32 ports), cable, and breakout box	HCOM-SC32- VT100	155
(A0652638)	Apertus Communications Board (SDLC)	ATI-HW-S-SCO	597
(A0639226)	Apertus Communications Board (Token Ring)	17-840037-00	30
(A0674960)	Cable for Arnet SDLC Card	00-440018-00	15
SCO Operating System (A0638855)	SCO Open Desktop Lite	103-800-000	
(A0638853)	SCO Development System	105-800-000	
Run-Time to Development Upgrade (A0679371)	Upgrade for systems with prompt manager. Includes SCO Development System, dongle, documentation, and RTU license.	NTZK13BA	
(A0679370)	Upgrade for systems without prompt manager. Includes SCO Development System, dongle, documentation, RTU license and prompt manager.	NTZK13AA	

Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
Cables (A0651350)	Digiboard DTE 8 Port DB25 Male Cable	76000021	
(Not Supplied by NT)	Bi-Tronics parallel cable for Laser and Dot-Matrix Printer (36-pin male <-> 25 pin male)	C2950A	
Processor Installation Kit (A0658784)	Processor Installation Kit; 75 MHz Processor, One Clip, One Adhesive Strip, One Heatsink	CPU-75 KIT	
Processor Installation Kit (A0658785)	Processor Installation Kit; 100 MHz Processor, One Clip, One Adhesive Strip, One Heatsink	CPU-100 KIT	
Processor Installation Kit (A0666779)	Processor Installation Kit; 133 MHz Processor, One Clip, One Adhesive Strip, One Heatsink	CPU-133 KIT	
RT Clock Chip (A0651681)	RT Clock Chip	DS1587	
Key Master (A0646699)	Key & Lock Master	MG5F-611494M	
Fan (A0647317)	Fan (100 cfm)	MG5F-629290	
Power Supply (A0656847)	Power Supply, 525 W	MG5F-617604	
Drive Tray (A0652237)	Drive Tray	MG5F-625634	

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Component/ NT Part Number	Description	OEM Part Number	MTBF (kHour)
LED Panel (A0646715)	Drive LED Panel	MG5F-626357	
LCD Cable (A0656874)	Cable, LCD	MG5F-632397	
Riser Board (A0659158)	Riser Board	MG5F-629183	

MRS and MRS/AP hardware part numbers and MTBF values

Table 3-6: Component List for MRS/Tower/Rackmount and MRS/AP

CPC Number	Description	Class ACL Code	MTBF (kHour)
BASE UNIT COMPONENTS			
A0651060	486 CPU with no Memory	R / C	92
A0651062	486 CPU with 32 Mbyte Memory	R / C	92
A0657777	CPU module battery	N / S	
A0675271	Backplane 18-Slot (Tower)	N / S	120
A0673859	Backplane 20-Slot (Rack and Tower)	N / S	120
A0651064	450 W Power Supply (Tower)	R / D	100
A0652687	Redundant Power Supply for DC-powered MRS/Rack	R / D	100
R0118019	Rack AC Power Cable	E / R	5
A0673862	Display Panel (Tower)	R / D	30
A0673861	Display Panel (Rack)	R / D	30
A0673789	Display Panel Controller (Digital I/O Card)	N / D	10
A0651040	Ethernet Controller	R / B	1266
A0651041	Token Ring Controller	R / B	138
A0651038	1.05 Gbyte disk drive (Tower)	N / B	800
A0651039	1.05 Gbyte disk drive (Rack)	N / B	800
A0651037	SCSI Disk Controller	R / D	455
A0658485	SCSI Cable	E / S	1000
A0658957	Floppy Disk Drive	N / R	30
A0658488	Floppy Cable	E / S	1000
A0637905	External High Density Tape Drive 2.5 Gbyte	N/R	30

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CPC Number	Description	Class ACL Code	MTBF (kHour)
A0680176	MRS/Tower hard disk mounting bracket		
A0680267	MRS/Rack hard disk mounting bracket		
A0659125	MRS/Rack cabinet rails		
A0651036	Serial I/O Controller	N / D	Not Avail
	Serial I/O Controller (New)	N / D	Not Avail
A0658690	Rack Fan Assembly	N / S	60
OPTIONAL COMPONENTS			
A0652687	Redundant Power Supply for DC-powered MRS/Rack		100
A0639011 ^a	Audio Interface Unit (for recording prompts)		155
NORTH AMERICAN NETWORK INTERFACES			
A0650996	LSI/120 Loopstart Network Interface Module	R / D	15
A0651035	D/121B Voice Processing Card	R / D	15
A0650990	D/240SC-T1 Interface	R / D	15
TTS / FAX / SR			
A0638229	2 Port Brooktrout Fax Card TR114-12P	R / D	217
A0638231	4 Port Brooktrout Fax Card TR114-14P	R / D	138
A0638233	8 Port Brooktrout Fax Card TR114-18P	R / D	87
A0651032	VRP Voice Recognition Card	R / D	15
A0651033	VRM/40 Discrete Voice Rec. Daughterboard (4 port)	R / D	15
A0651034	VRM/2C Continuous Voice Rec. Daughterboard (2 port)	R / D	15
A0651002	Antares 2000/33 TTS board	R / D	15

CPC Number	Description	Class ACL Code	MTBF (kHour)
A0674588	Antares 2000/50 TTS board	R / D	15
UPS / MODEM			
A0674029	Modular Phone Cable RJ11	E / S	5
A0674031	Audio Cable RCA to RCA	E / S	5
A0623885	USR 9600 Baud Modem	N / D	100
A0663900 ^b	14.4 kbit/s external (V.32)		100
A0641975	28.8 kbit/s external (V.34)		100
A0674453	33.6 kbit/s external (V.34)		100
A0657727	Modem Cable	E / R	1000
A0601464	Modem cable (25-Pin male <-> 9-Pin female)		
A0656296	Smart UPS (700VA, 120 V)		35
A0655449	Smart UPS (700VA, 220 V)		35
A0656294	APC Smart UPS 700 VA Rackmount 120V for MRS/Rack AC		
A0654949	UPS Data Cable for MRS/Tower or MRS/Rack	E / S	1000
MISCELLANEOUS / CABLES			
A0673847	Alarm Cable (internal)	E / R	25
A0676111	Control Cable (internal)	E / R	25
A0673857	Display Cable (internal)	E / R	25
A0673855	Keyboard Cable (internal)	E / S	25
A0657566	10 Connector PEB Cable	E / D	1000
A0657730	Loopstart Trunk Interface Cable (DB25F to RJ23X)	E / S	1000
A0657728	MRS to Terminal Cable (25-pin Female to 25-pin Male)	E / R	1000

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CPC Number	Description	Class ACL Code	MTBF (kHour)
A0658110	Air Filter (Tower)	E / R	N/A
A0674788	12-Line Modular Multi-Jack Cable Adapter (RJ23X to RJ11)	E / R	5
A0673888	Null Modem	E / R	N/A
A0673982	Alarm Cutoff (ACO) Switch	E / S	20
A0677968	PEB terminator	E / S	15
A0640736	Rack Cabinet (19")	R / S	N/A
A0676117	16 Port VT100 Cable and Ports Module		
A0676118	32 Port VT100 Cable and Ports Module		
INTERNATIONAL COMPONENTS			
A0658658	LSI/80 Loopstart Network Interface Module	R / D	15
A0658685	D/81A Voice Processing Card	R / B	15
A0685242	LSI/80 Loopstart Cable		
A0657772	Aculab 30 Port E1 (75 Ohm) Without Daughter Card	R / D	350
A0659100	Aculab 30 Port E1 (75 Ohm) with Daughter Card	R / D	350
A0657774	Aculab 60 Port E1 (75 Ohm) without Daughter Card	R / D	350
A0676050	Aculab 60 Port E1 (75 Ohm) with Daughter Card	R / D	350
A0657617	D/41ESC 4 Port HD Card	R / D	15
A0657620	D/320SC Voice Processing Card	R / D	131
SPARES KITS			
A0640190	MRS/Tower Spare Parts Kit		
A0651062	486 CPU with 32 Mbyte memory		

CPC Number	Description	Class ACL Code	MTBF (kHour)
A0651064	1 Power Supply		100
A0651036	1 Serial I/O		
A0651037	1 SCSI Controller		
A0658485	1 SCSI Cable		
A0658488	1 Floppy Cable		
A0640194	MRS/Rackmount AC Spare Parts Kit		
A0651062	486 CPU with 32 Mbyte memory		
A0652688	1 AC Power Supply		100
A0651036	1 Serial I/O		
A0651037	1 SCSI Controller		
A0651040	1 Ethernet Controller		
A0658485	1 SCSI Cable		
A0658488	1 Floppy Cable		
A0640192	MRS/Rackmount DC Spare Parts Kit		
A0651062	486 CPU with 32 Mbyte memory		
A0652681	1 DC Power Supply		100
A0651036	1 Serial I/O		
A0651037	1 SCSI Controller		
A0658485	1 SCSI Cable		
A0651040	1 Ethernet Controller		
A0658488	1 Floppy Cable		

a. The grey rows indicate components that are common to the MRS and MRS/AP. The rows that are not grayed indicate components that are MRS/Tower/Rack specific.

b. The 14.4 kbit/s modem is only supported on the MRS/AP.

Chapter 4: System software

Operating system

The SCO UNIX Operating System is provided by the Santa Cruz Operation.

SCO Open Desktop Lite

The Open Desktop Lite release 3.2v4.2 will be used as the base Operating System.

SCO Open Desktop Development System

The SCO Desktop Development System is a supplement to the SCO Open Desktop family of workstation operating systems (2 user licence). Once installed on the SCO Open Desktop system or the SCO Open Server system, the SCO Open Desktop Development System provides the foundation for advanced software development. It includes a set of industry-standard tools for developing graphical user interface, networking and database applications. The SCO Open Desktop Development System provides development system facilities for each SCO Open Desktop component, as well as interactive debugging tools, program maintenance and analysis tools, and on-line documentation. The Open Desktop Development System 3.2v4.2 used by Nortel IVR 2.5/S is supplied on tape media.

Nortel IVR 2.5/S software

Nortel IVR 2.5/S uses IVR Generator 2.00.12 software on the AP, and MRS 3.02.02 software on the MRS/Rack and MRS/Tower. MRS 3.02.02 software includes the Service Console Interface (SCI) software for administration and maintenance tasks on the MRS. Nortel IVR 2.5/S software is a PEB-only offering from Nortel.

Chapter 5: Telco interface support

Switch support

Table 5-1 indicates the trunk types supported for various types of switches in Nortel IVR 2.5/S.

Table 5-1: Supported switches

Switch	Trunk Type
AT&T Definity	G3 T1 FXS and analog (both ACD and not)
Rolm	T1 FXS and analog (both ACD and not)
DMS/100	T1 and analog (both ACD and not)
Nortel M1	T1 and analog (both ACD and not)
Any	analog

Trunk information

Nortel IVR 2.5/S can interface with the Telco network using the trunk types listed in Table 5-2.

Table 5-2: Supported trunk types

Trunk	Trunk Type/Protocol
Loopstart	Loopstart
	Loop-B
	LCO-Loopstart
	ACD
T1	T1-E&M
	T1-E&M-B
	T1-W-ANI-E&M
	T1-W-DNIS-E&M
	T1-W-D-A-E&M
	T1-W-E&M
	T1-E&M-Wink
	Line side ACD (M1 only)
	PRI
E1	Enhanced DPNSS
	Belgium, Brazil, Mexico, China, Malaysia, Ericsson E&M (EEMA)

Chapter 6: Run-Time vs. Development system

A run-time and a development version of the Nortel IVR 2.5/S product are offered to Nortel customers. From an engineering perspective, there are two differences between a run-time and a development system:

- A development system is loaded with the SCO Open Desktop Development System Release 3.0. A run-time system does not include the SCO development system.
- The keylock adapter for a run-time system is programmed differently from the keylock adapter of a development system. Run-time system users cannot save IVR applications edited with the IVR Generator's application editor.

Chapter 7: SQL database support

With Nortel IVR 2.5/S, a relational database, (Informix, Sybase, Oracle or Ingres) is supported in addition to the local informational database. The RDBMS can be local (that is, running on the AP or MRS/AP) or remote (that is, running on a stand-alone server other than the AP or MRS/AP). Remote SQL database client (such as SQL*NET from Oracle) software must be run locally on the AP or MRS/AP for remote RDBMS configurations.

Table 7-1 indicates the supported SQL database versions.

Table 7-1: SQL database versions

Database	Version
Informix	5.02 SE
Ingres	6.4.* ^a
Oracle	7.0 or 7.1
Sybase	10.0.* ^b

a. subrelease 04 or 05

b. subrelease 02 or 03

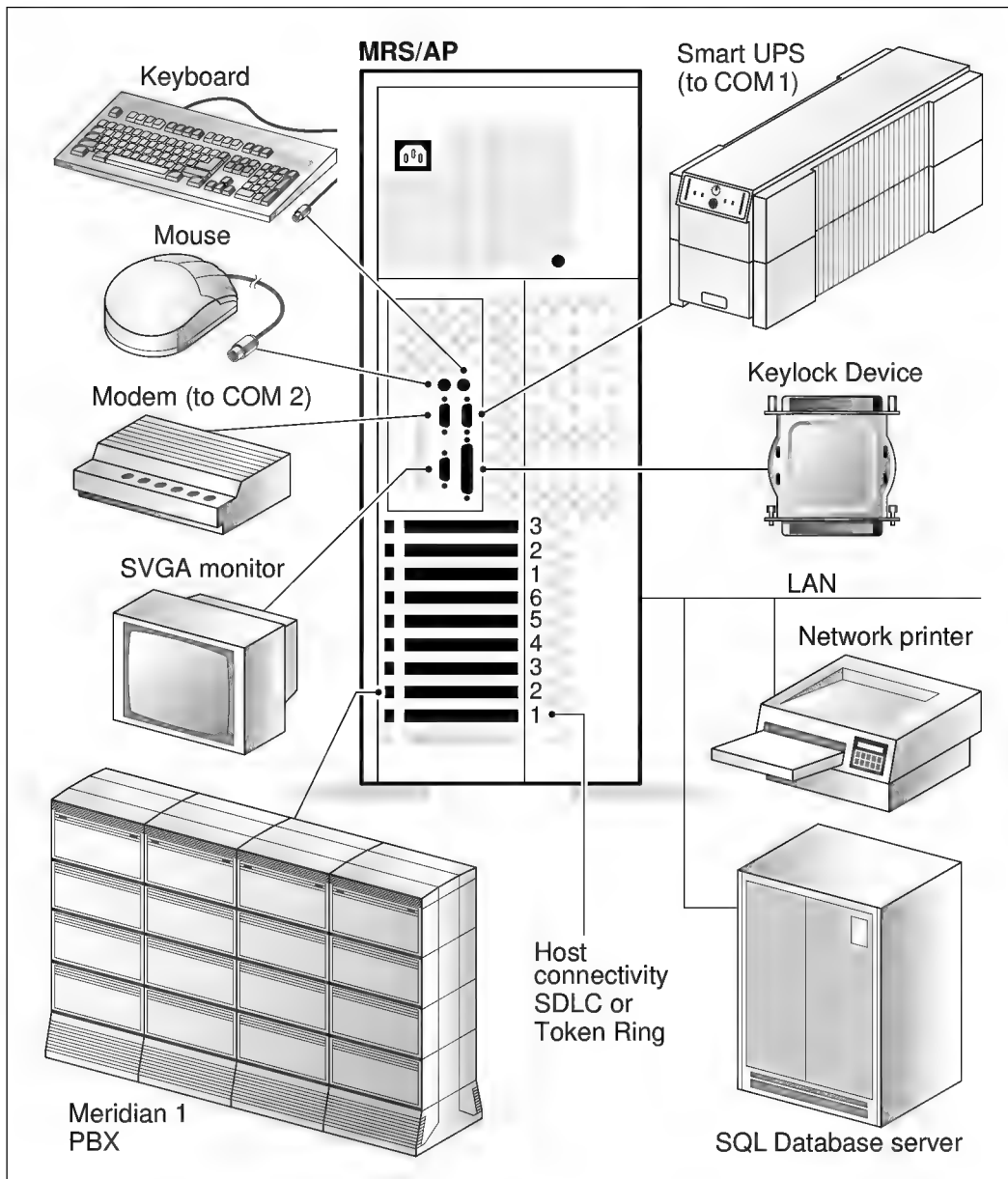
Chapter 8: System configuration

Figure 8-1 on page 8-2 shows the base folded system cabling configuration.

Figure 8-2 on page 8-3 shows the base unfolded system cabling configuration.

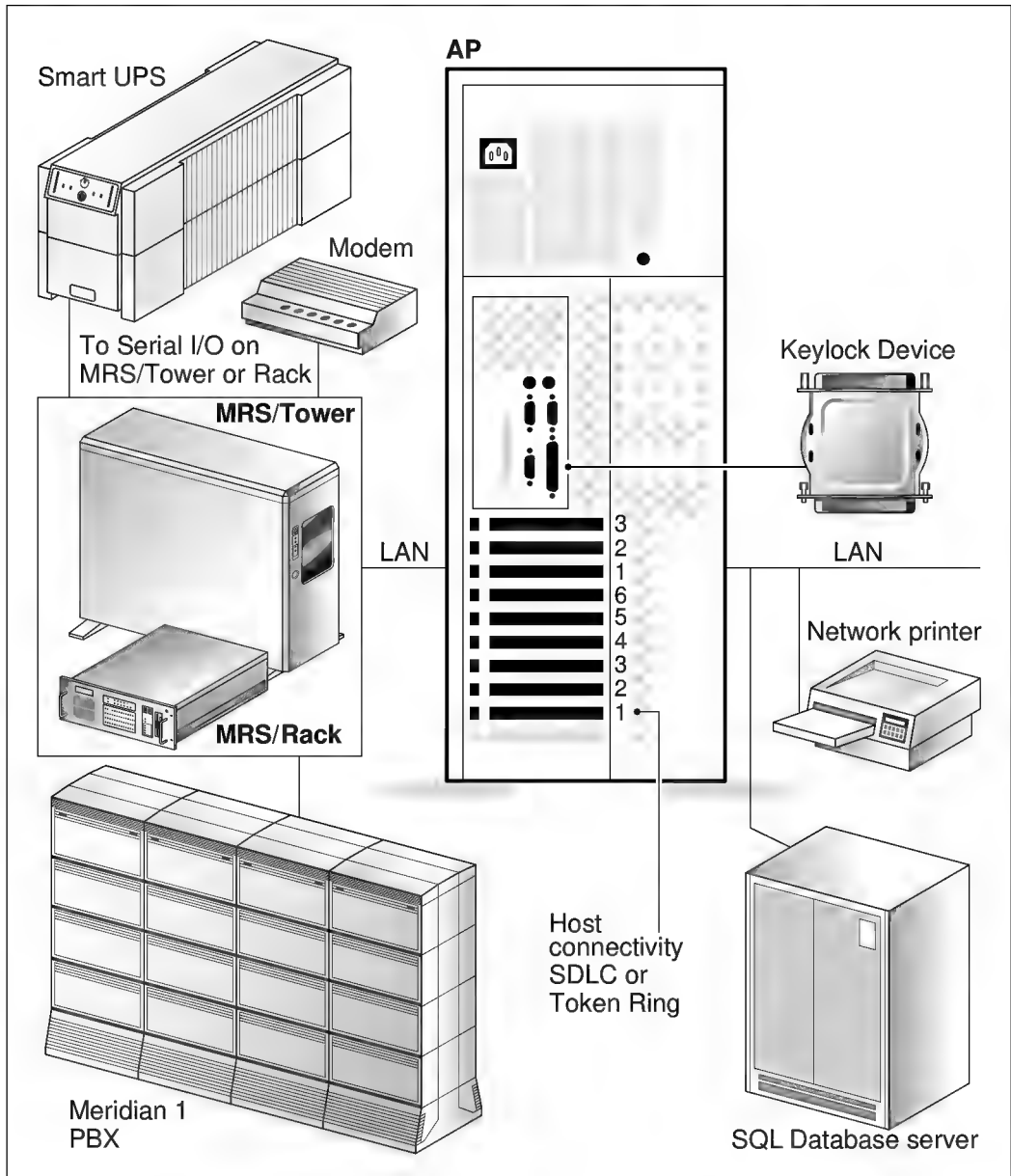
8-2 System configuration

Figure 8-1: Base Folded System Cabling Configuration (MRS/AP)



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Figure 8-2: Base Unfolded System Cabling Configuration (MRS and AP)



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PEB connectivity

PEB connectivity rules

The following are PEB connectivity rules:

- For all configurations with more than one PEB card in the system, one end of the PEB must always be connected to either a high density card(s) or a telco interface card(s).
- For low density configurations, the opposite end of the PEB must always be connected to a voice processing card(s).
- For low density configurations, option cards must be installed between the telco interface card(s) and the voice processing card(s).
- For high density configurations using option card(s), an option card should terminate the PEB.
- The first and last board on the PEB must be terminated, while other boards should not be terminated.
- In cases where a high density card is the only card in the system, such as D/240SC-T1 or D/41ESC, a PEB terminator should still be installed on the card.
- Switch 1-1 on the fax card should be off, with the exception of the fax card furthest from the CPU (this is illustrated in the examples in the next section).
- Interrupt terminator JP7 must only be installed on the D/121B or D/81A card furthest from the CPU.
- In a high density configuration, interrupt terminator JP7 should be installed on the voice recognition card furthest from the CPU.
- If more than one LSI/120 or LSI/80 interface card is installed on the same PEB cable, only the first card (time slots 00-11 for LSI/120 or 00-07 for LSI/80) should be clock master. On that card, SW1-3 must be OFF. All other LSI/120 or LSI/80 cards on the same PEB must have SW1-3 in the ON position.
- Two PEBs must be used with the 60-port E1 card. Both PEBs attach to the E1 card, and extend to the left and right side of the card. A D/320SC voice processing card should be connected on the end of each PEB. Option cards are placed between the E1 card and each D/320SC card.

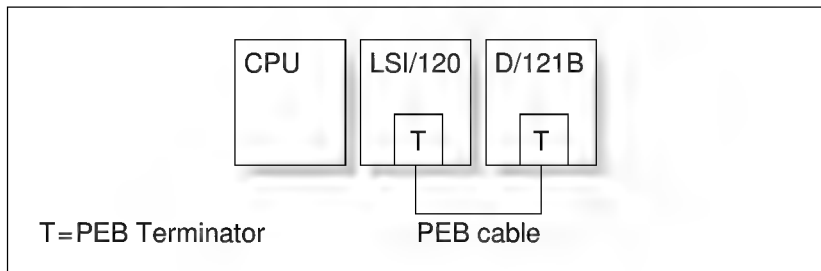
- Cards on any one PEB must have a contiguous slot allocation (for example, a card on PEB 2 must not be inserted in a slot between the first card and last card of PEB 1).

Telephony hardware PEB bus connectivity examples

Note: The figures that are included in this section show the boards that must be terminated on the PEB. Terminators are identified as “T” for an external terminator that must be plugged into a socket on the module, and “t” for an internal terminator that is built into the card. In Nortel IVR 2.5/S, the only cards which have an internal terminator are the 30- and 60-port Aculab E1 cards. As a result, they do not require external PEB terminators to be installed. The internal terminator is installed by the card manufacturer, and cannot be removed.

The simplest PEB configuration consists of a network interface module and voice processing module, as shown in Figure 8-3.

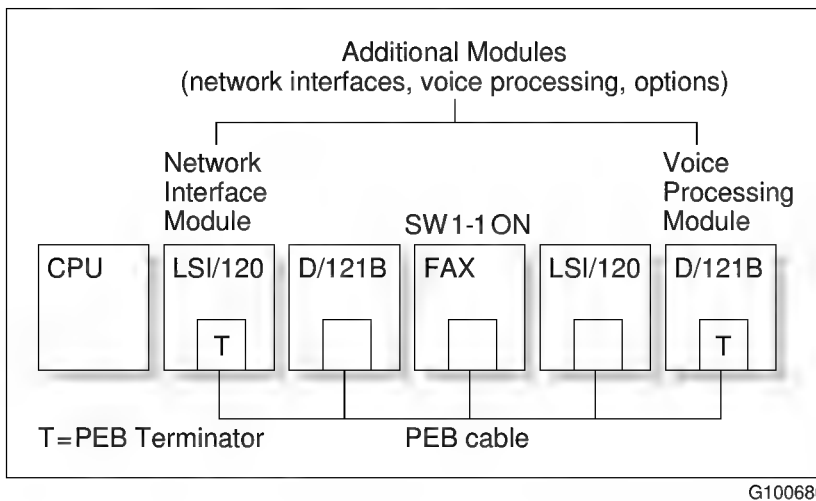
Figure 8-3: PEB configuration for a 12-channel loopstart interface



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The PEB can support up to two 12-channel loopstart network interface modules. The option modules (for example, fax, voice recognition) whose resources are available to all channels on the PEB should be installed between the end modules, as shown in Figure 8-4 on page 8-6. The order of the option modules is not important.

Figure 8-4: Multiple modules on a PEB



The following figures provide several examples of PEB cabling rules.

Figure 8-5: PEB cabling when using the D/240SC-T1 card

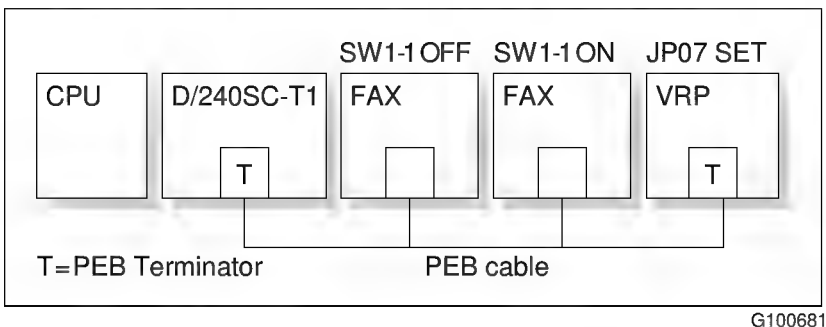
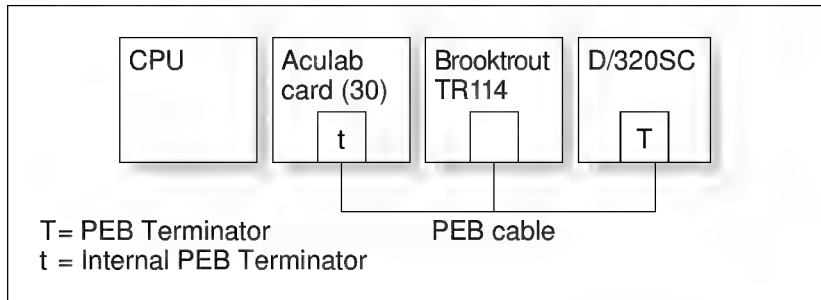
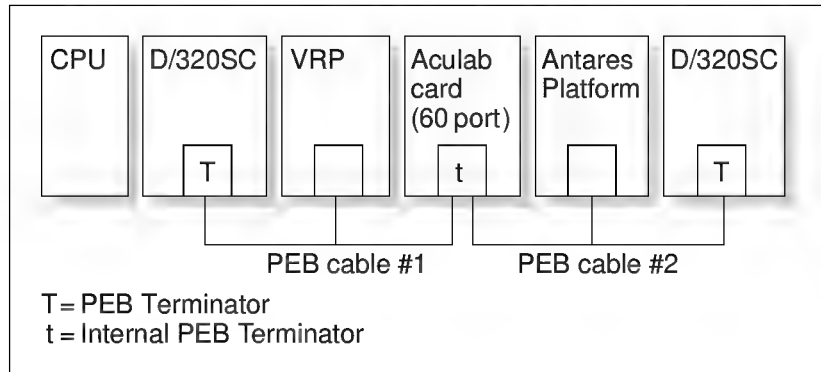
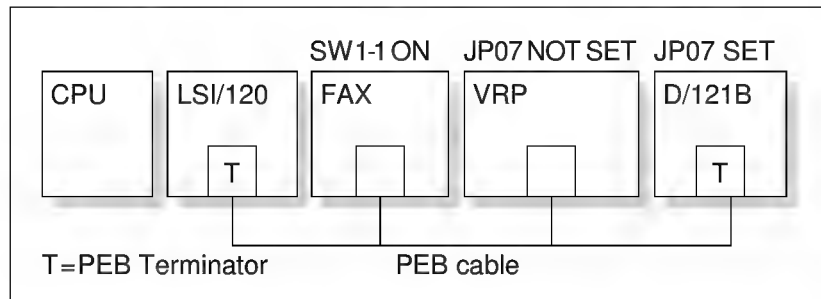


Figure 8-6: PEB cabling when using the 30-port Aculab E1 card

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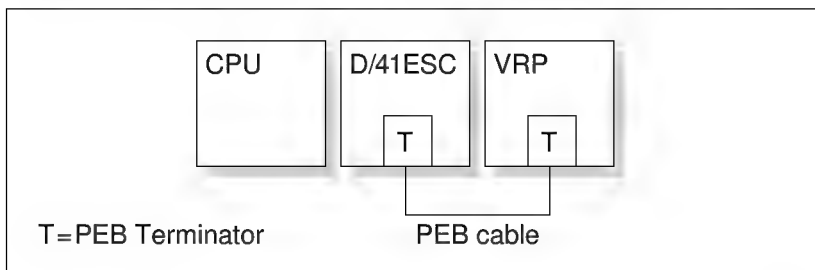
Figure 8-7: PEB cabling when using the 60-port Aculab E1 card

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Figure 8-8: PEB cabling when using a single loopstart card

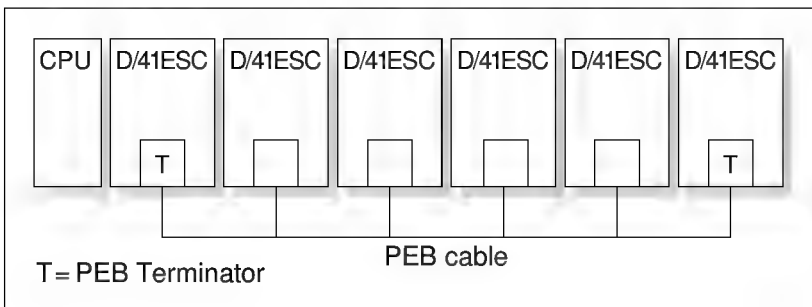
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Figure 8-9: PEB Cabling when using a single D/41ESC card



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Figure 8-10: PEB Cabling when using multiple D/41ESC cards



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Physical I/O port configuration

The following tables illustrates the I/O port configuration.

Table 8-1: Device name and legends for AP

Legend/Label	Used for	Device name
COM1		tty1a
		tty1A
COM2	UPS	tty2a
		tty2A
Parallel Port	Keylock	lp0

Table 8-2: Device name and legends for MRS/Tower or MRS/Rack

Legend/Label	Used for	Device name
COM1		tty1a
	Modem	tty1A
COM2	UPS	tty2a
		tty2A
Parallel Port		lp0

Table 8-3: Device name and legends for MRS/AP

Legend/Label	Used for	Device name
COM1	UPS	tty1a
		tty1A
COM2		tty2a
	Modem	tty2A
Parallel Port	Keylock	lp0

Disk partitioning

This section describes the disk usage for Nortel IVR 2.5/S by showing the disk partitioning and the software usage of the disk.

The disk drive used on the Nortel IVR 2.5/S AP or MRS/AP is a 1.2 Gbyte Quantum or Seagate. The hard disks have a formatted capacity of 1.075 and 1.060 Gbyte respectively.

The MRS uses a 1 Gbyte Seagate hard disk, which has a formatted capacity of 1.060 Gbyte.

The primary hard disk in the MRS and MRS/AP are partitioned similarly. It is partitioned into two UNIX partitions and one DOS partition. One of the UNIX partitions is an active partition. On the MRS/AP, this active partition stores the root, swap, and /u file systems. On the MRS, the active partition contains all of the file systems found on the MRS/AP except the /u file system. The second UNIX partition is inactive, and is used to store one or two VSN volumes. The MRS contains two VSN volumes, while the MRS/AP contains one VSN volume. The disk on the AP differs only in the fact that it does not have an inactive UNIX partition, since it does not store VSNs. The list below describes the purpose of each of the areas on the AP, MRS/AP, and MRS/AP disks.

- **Root** This partition holds the bootable operating system and some temporary IVR files.
- **Swap** Used by the operating system, whenever required, during operations.
- **DOS** Used to store various option boards diagnostic utilities.
- **/u** Used for the IVR applications: Generations, and IVR third party software (SQL databases and so on).
- **VSN** Used for storing prompts, voice messages, and fax documents.

Disk partitioning on the AP

Partitioning a single disk on an AP

The following table provides disk partitioning information for a single hard disk on the AP.

Table 8-4: AP—1-Gbyte disk

Disk 0
Root 250 Mbyte
/u 682 Mbyte
DOS 10 Mbyte
Swap 64 Mbyte

Partitioning multiple disks on an AP

The AP supports up to four hard disks. The additional three hard disks are configured the same way; each one has a single partition that can be used for additional data or software.

Table 8-5: AP—Up to four 1-Gbyte disks

Disk 0	Disk 1	Disk 2	Disk 3
Root 250 Mbyte	/u1 1-Gbyte	/u2 1-Gbyte	/u3 1-Gbyte
/u 682 Mbyte			
DOS 10 Mbyte			
Swap 64 Mbyte			

Disk partitioning on an MRS

Partitioning a single disk on an MRS

The following tables provide disk partitioning information for a 1-Gbyte disk on the MRS. There is one configuration available that does not use disk mirroring, and one configuration that uses disk mirroring.

Table 8-6: MRS—1-Gbyte disk

Disk 0
Root 77 Mbyte
DOS 10 Mbyte
Swap 31 Mbyte
Storage Volume A 442 Mbyte
Storage Volume B 442 Mbyte

Table 8-7: MRS—1-Gbyte disk, disk mirroring

Disk 0	Disk 1
Root 77 Mbyte	Root 77 Mbyte
DOS 10 Mbyte	DOS 10 Mbyte
Swap 31 Mbyte	Swap 31 Mbyte
Storage Volume A 442 Mbyte	Storage Volume A 442 Mbyte
Storage Volume B 442 Mbyte	Storage Volume B 442 Mbyte

Partitioning two disks on an MRS

The following tables provide disk partitioning information for two 1-Gbyte disks on the MRS. There are two configurations available.

Table 8-8: MRS—two 1-Gbyte disks (configuration 1)

Disk 0	Disk 1
Root 77 Mbyte	Storage Volume C 500 Mbyte
DOS 10 Mbyte	Storage Volume D 500 Mbyte
Swap 31 Mbyte	
Storage Volume A 442 Mbyte	
Storage Volume B 442 Mbyte	

Table 8-9: MRS—two 1-Gbyte disks (configuration 2)

Disk 0	Disk 1
Root 77 Mbyte	Storage Volume C 1 Gbyte
DOS 10 Mbyte	
Swap 31 Mbyte	
Storage Volume A 442 Mbyte	
Storage Volume B 442 Mbyte	

Partitioning three disks on an MRS

The following table provides disk partitioning information for an MRS with three 1-Gbyte disks. This is the only configuration available.

Table 8-10: MRS—three 1-Gbyte disks

Disk 0	Disk 1	Disk 2
Root 77 Mbyte	Storage Volume C 1 Gbyte	Storage Volume D 1 Gbyte
DOS 10 Mbyte		
Swap 31 Mbyte		
Storage Volume A 442 Mbyte		
Storage Volume B 442 Mbyte		

Disk partitioning on an MRS/AP

Partitioning a single disk on an MRS/AP

The following table shows disk partitioning for a single 1-Gbyte disk on the MRS/AP. This is the only configuration available.

Table 8-11: MRS/AP—1-Gbyte disk

Disk 0
Root 250 Mbyte
/u 470 Mbyte
DOS 30 Mbyte
Swap 100 Mbyte
Storage Volume A 156 Mbyte

Partitioning two disks on an MRS/AP

The following table shows disk partitioning for two 1-Gbyte disks on the MRS/AP. This is the only configuration available.

Table 8-12: MRS/AP—two 1-Gbyte disks

Disk 0	Disk 1
Root 250 Mbyte	Storage Volume B 500 Mbyte
/u 470 Mbyte	Storage Volume C 500 Mbyte
DOS 30 Mbyte	
Swap 100 Mbyte	
Storage Volume A 156 Mbyte	

SCSI ID configuration on the AP and MRS/AP

The Nortel IVR 2.5/S AP and MRS/AP SCSI ID configuration must be followed as indicated in Table 8-13.

Table 8-13: SCSI ID configuration on the AP and MRS/AP

SCSI ID	Device	Comments
0	First Disk	Should always be located in top left bay of hot-swap area (Wide-SCSI distribution)
1	Second Disk	Must set jumper settings on the drive
2	Tape Drive	Narrow SCSI distribution
3	Third Disk	Must set jumper settings on the drive (only supported on the AP)
4	Fourth Disk	Must set jumper settings on the drive (only supported on the AP)
7	SCSI Controller	PCI Adaptec Controller

SCSI ID configuration on the MRS Tower/Rack

The Nortel IVR 2.5/S MRS SCSI ID configuration must be followed as indicated in Table 8-14.

Table 8-14: SCSI ID configuration on the MRS Tower/Rack

SCSI ID	Device	Comments
0	First Disk	Should always be connected to the last connector on the SCI cable.
1	Second Disk	Must set jumper settings on the drive
2	Third Disk	Must set jumper settings on the drive
7	SCSI Controller	Adaptec Controller

Interrupt Requests and system I/O map

Interrupt Request:

Interrupt ReQuests (IRQs) are used in the Nortel IVR 2.5/S hardware platform (PC). They are the way a device signals the data bus and the CPU that it needs attention. In other words, an IRQ is a signal sent to the central processing unit (CPU) to temporarily suspend normal processing and transfer control to an interrupt handling routine. Interrupts may be generated by conditions such as completion of an I/O process, detection of hardware failure, and so on.

I/O address

The I/O address is the starting memory address through which the CPU exchanges data with peripheral devices such as floppy drives, SCSI devices, and COM ports (tty's). It is important to notice that no devices should share the same I/O address in memory.

DMA channel

A DMA channel is used by any high-speed communication device that must send and receive information at high speeds with the system memory. A network adapter is an example of a device using a DMA channel. DMA channels can be shared by devices if they are not using it at the same time. An example would be a network adapter and a tape drive.

Base address

Base address is the starting address of a shared memory block. Each card has its own base address, although cards of the same type usually use the same base address.

Shared memory

Shared memory is a specific area in memory where various devices load their drivers, which then talk to the device by using the I/O address. Each device has its own address range which starts at the base address. This range cannot conflict with any other device unless it is a device of the same type (for example, 8-port and 16-port Digiboard). Shared memory is divided into 4, 8, 16, 32, and 64 kbyte blocks.

Memory map, I/O address and IRQ settings for AP

Table 8-15: AP IRQ, I/O, Memory Allocation Table

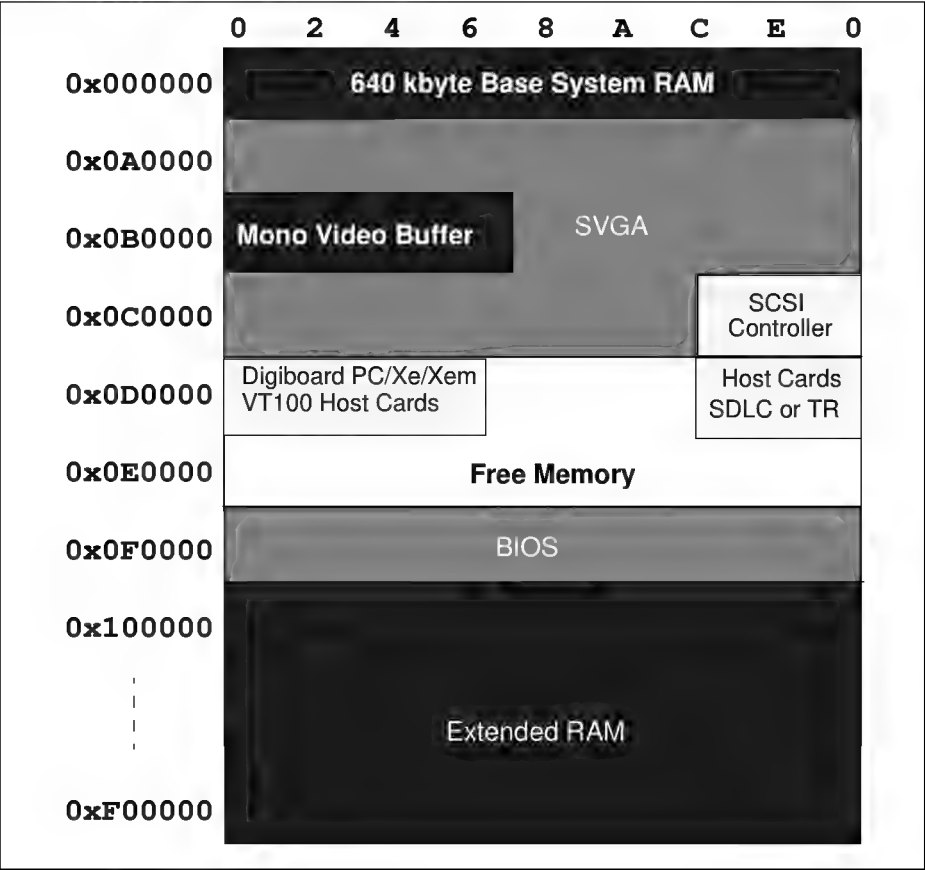
Note: Cards using the same IRQ and appearing in a shaded row are mutually exclusive.

IRQ	Device type	Shared memory address range	I/O address	DMA channel
0	Internal Timer	—	—	—
1	Keyboard Buffer	—	—	—
2 ^a	Reserved for PIC	—	—	—
3	COM 2 (UPS)	—	0x3F8-0x3FF	—
4	Not Used	—	—	—
5	Not Used	—	—	—
6	Floppy Drive	—	0x3F2-0x3F7	2
7	Parallel Port/Dongle	—	0x378-0x37F	—
8	Clock/Calendar	—	0x070-0x07F	—
9	Not Used	—	—	—
10	Madge Token Ring Smart 16/4 AT Plus Ringnode Card	—	0x1A20-0x1A2F	6
10 ^b	PCI ZYNX Ethernet Adapter	—	0xF880-0xF8FF	—
11 ^c	SCSI Adapter Controller VGA Video Controller	0xCC000-0xCFFFF 0xA0000-0xCBFFF	0xFC00-0xFCFF —	— —
12	Keyboard Mouse	—	0x060-0x064	—
13	FPU (Floating Point Unit)	—	—	—
14 ^d	PCI ZYNX Ethernet Adapter	—	0xF880-0xF8FF	—
15	Arnet Sync 570 SDLC Host Card	0xDC000-0xDFFFF	0x360-0x36F	—

IRQ	Device type	Shared memory address range	I/O address	DMA channel
15	Madge Smart 16/4 Plus RN Host Card (Token Ring)	—	0x3A20x3A2F	5
—	Digiboard PC/Xe VT-100	0xD0000-0xD3FFF	0x100	—
—	Digiboard PC/Xem VT-100	0xD0000-0xD7FFF	0x104	—
N/A	640 kbyte System RAM	0x00000-0x9FFFF	—	—
N/A	Mono Video Buffer	0xB0000-0xB7FFF	—	—
N/A	BIOS and Basics	0xF0000-0xFFFFF	—	—
N/A	Extended RAM	0x100000-0xFDFFFF	—	—

- a. IRQs 2 and 9 are the same.
- b. Assumes IDE controller has been disabled. This IRQ should only be used when a Token Ring LAN connection to MRS and an Ethernet LAN connection for CCIP are required. Only one PCI ZNYX Ethernet Adapter is supported in the AP.
- c. SCSI controller and VGA video controller are PCI based controllers that share the same IRQ. They should be set to IRQ 11 using Intel's DOS based SCU (System Configuration Utility).
- d. Assumes IDE controller has been disabled. This IRQ should only be used when a Token Ring LAN connection to MRS and an Ethernet LAN connection for CCIP are required. Only one PCI ZNYX Ethernet Adapter is supported in the AP.

Figure 8-11: AP Shared Memory Map



Memory map, I/O address and IRQ settings for MRS/AP

Table 8-16: MRS/AP IRQ, I/O, Memory Allocation Table

Note: Cards using the same IRQ and appearing in a shaded row are mutually exclusive except for the D/121 voice processing card, which can share IRQ 10 with a VRP voice recognition board.

IRQ.	Device type	Shared memory address range	I/O address	DMA channel
0	Internal Timer	—	—	—
1	Keyboard Buffer	—	—	—
2 ^a	Reserved for PIC	—	—	—
3	COM 2 (MODEM)	—	0x2F8-0x2FF	—
4	COM 1 (UPS) ZNYX PCI Ethernet Adapter ^b	—	0x3F8-0x3FF 0xF880-0xF8FF	—
5	D/41ESC D/240SC-T1 ^c D/320SC Antares Text-To-Speech Card ^d	0xD0000-0xD7FFF 0xD0000-0xD7FFF 0xD0000-0xD7FFF —	— 0x340-0x343 — 0x210-0x217	— — — —
6	Floppy Device	—	0x3F0-0x3F7	2
7	Parallel Port/Dongle	—	0x378-0x37F	—
8	Clock/Calendar	—	0x070-0x07F	—
9	ZYNX PCI Ethernet Adapter Madge Smart 16/4 Plus Ringnode	— —	0xF880-0xF8FF 0x1A20-0x1A2F	— 6

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IRQ.	Device type	Shared memory address range	I/O address	DMA channel
10	VRP Voice Recognition Card	0xD8000-0xDBFFF	0x200-0x203	—
	D/121 or D/81A	0xD0000-0xD7FFF	0x340-0x343	—
	Antares Text-To-Speech Card	—	0x210-0x217	—
	Madge Smart 16/4 Plus RN Host Card (Token Ring)	—	0x3A20-0x3A2F	5
11 ^e	SCSI Controller	0xCC000-0xCFFFF	0xFC00-0xFCFF	—
	VGA Video Controller	0xA0000-0xCBFFF	—	—
12	Keyboard Mouse	—	0x060-0x064	—
13	FPU (Floating Point Unit)	—	—	—
14 ^f	Brooktrout Fax TR114-I2P	—	0x120-0x12B	—
	Brooktrout Fax TR114-I4P	—	0x120-0x133	—
	Brooktrout Fax TR114-I8P	—	0x120-0x143	—
	ZNYX PCI Ethernet Adapter ^g	—	0xF880-0xF8FF	—
15	D/240SC-T1	0xD0000-0xD7FFF	0x320-0x323	—
	Aculab E1 Card (30 and 60 port) ⁱ	0xE0000-0xEFFFF	0x320-0x323	—
	Arnet Sync 570 Host Card (SDLC)	0xDC000-0xDFFFF	0x360-0x36F	—
15 ^h	Madge Smart 16/4 Plus RN Host Card (Token Ring)	—	0x3A20-0x3A2F	5
—	Digiboard PC/Xe VT-100	0xDC000-0xDFFFF	0x100	—
—	Digiboard PC/Xem VT-100	0xD8000-0xDFFFF ^j 0xE0000-0xE7FFF ^k	0x114 0x114	—

a. IRQs 2 and 9 are the same.

b. The ZNYX Ethernet Adapter should only use this IRQ if a Token Ring LAN connection to a corporate LAN and an Ethernet LAN connection for CCIP are required. If both IRQ 4 and 14 are available, IRQ 4 should be used. COM 1 has to be disabled before IRQ 4 can be used.

Only one ZNYX PCI Ethernet Adapter is supported in the MRS/AP.

c. D/240SC-T1 Card requires two IRQs, 5 and 15.

- d. Antares TTS Card can also use IRQ 5 in low density configuration. A TTS Card requires an IRQ less than or equal to 12.
- e. SCSI Controller and VGA Video Controller are PCI based controllers that can share the same IRQ. They must both be set to IRQ 11 using Intel's DOS based SCU (System Configuration Utility).
- f. IDE controller must be disabled, as it uses IRQ 14 by default.
- g. The ZNYX Ethernet Adapter should only use this IRQ if a Token Ring LAN connection to a corporate LAN and an Ethernet LAN connection for CCIP are required. If both IRQ 4 and 14 are available, IRQ 4 should be used. COM 1 has to be disabled before IRQ 4 can be used. Only one ZNYX PCI Ethernet Adapter is supported in the MRS/AP.
- h. The Madge Smart 16/4 Plus RN Host Card uses IRQ 15 by default. For high density T1 interface, with fax, but no voice recognition or TTS, the Madge Smart 16/4 Plus RN Host Card can use IRQ 10.
- i. In order for the Aculab E1 card to use the 0xE0000-0xEFFFF shared memory range, ROM BIOS shadowing must be disabled for that memory range.
- j. The shared memory range 0xD8000-0xDFFFF should be used if the system has an Aculab card and no voice recognition card.
- k. The shared memory range 0xE0000-0xE7FFF should be used by the Digiboard PC/Xem only when an Aculab card is not being used.

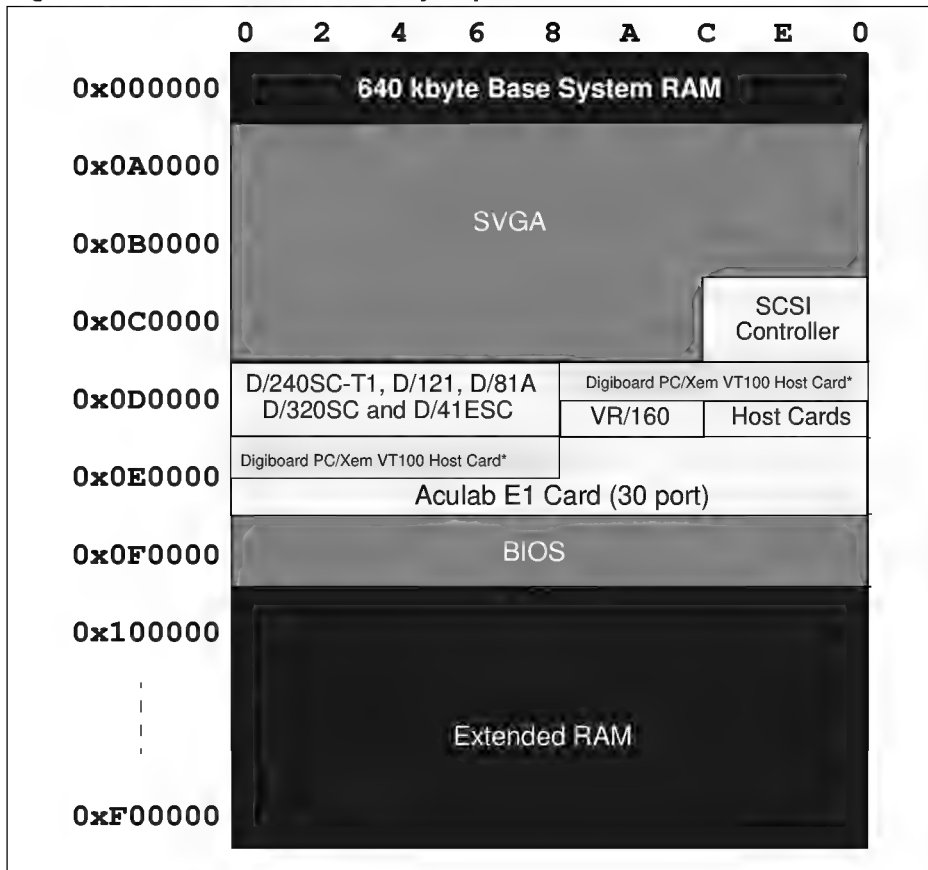
Table 8-17: Memory, I/O, and IRQ settings for multiple boards of the same type on an MRS/AP

Device type	IRQ	Shared memory address	I/O address	DMA channel
Dialogic D/240SC-T1 ch 00-23	5 15	0xD0000-0xD7FFF	0x340-0x343 0x320-0x323	—
Dialogic D/240SC-T1 ch 24-47	5 15	0xD0000-0xD7FFF	0x344-0x347 0x324-0x327	—
Dialogic D/121B ch 00-11	10	0xD0000-0xD7FFF	0x340-0x343	—
Dialogic D/121B ch 12-23	10	0xD0000-0xD7FFF	0x344-0x347	—
Dialogic D/121B ch 24-35	10	0xD0000-0xD7FFF	0x348-0x34B	—
Dialogic D/81A ch 00-07	10	0xD0000-0xD7FFF	0x340-0x343	—
Dialogic D/81A ch 08-15	10	0xD0000-0xD7FFF	0x344-0x347	—
Dialogic D/81A ch 16-23	10	0xD0000-0xD7FFF	0x348-0x34B	—
Dialogic D/320SC-T1 ch 00-29	5	0xD0000-0xD7FFF	—	—

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Device type	IRQ	Shared memory address	I/O address	DMA channel
Dialogic D/320SC-T1 ch 30-59	5	0xD0000-0xD7FFF	—	—
Dialogic D/41ESC (4 port) ch 00-23	5	0xD0000-0xD1FFF	—	—
VCS VRP card #1	10	0xD8000-0xD9FFF	0x200-0x203	—
VCS VRP card #2	10	0xDA000-0xDBFF	0x204-0x207	—
Antares TTS card ch 00-15	5 or 10	—	0x210-0x217	—
Antares TTS card ch 16-31	5 or 10	—	0x218-0x21F	—
Antares TTS card ch 32-47	5 or 10	—	0x220-0x227	—
Antares TTS card ch 48-63	5 or 10	—	0x228-0x22F	—
Brooktrout Fax TR114-I2P ch 00-01	14	—	0x120-0x12B	—
Brooktrout Fax TR114-I2P ch 02-03	14	—	0x148-0x153	—
Brooktrout Fax TR114-I2P ch 04-05	14	—	0x170-0x17B	—
Brooktrout Fax TR114-I2P ch 06-07	14	—	0x198-0x1A3	—
Brooktrout Fax TR114-I4P ch 00-03	14	—	0x120-0x133	—
Brooktrout Fax TR114-I4P ch 04-07	14	—	0x148-0x15B	—
Brooktrout Fax TR114-I4P ch 08-11	14	—	0x170-0x183	—
Brooktrout Fax TR114-I4P ch 12-15	14	—	0x198-0x1AB	—
Brooktrout Fax TR114-I8P ch 00-07	14	—	0x120-0x143	—
Brooktrout Fax TR114-I8P ch 08-15	14	—	0x148-0x16B	—
Brooktrout Fax TR114-I8P ch 16-23	14	—	0x170-0x193	—
Brooktrout Fax TR114-I8P ch 24-31	14	—	0x198-0x1BB	—

Figure 8-12: MRS/AP Shared Memory Map



* See Table 8-16 on page 8-21 for details on Digiboard PC/Xem host communication board.

Note: High density cards are SPAN cards. They are D/41ESC and D/240SC-T1 cards which combine telco and voice processing functionality.

Memory map, I/O address, and IRQ settings for MRS/Tower and MRS/Rack

Table 8-18: MRS/Tower/Rack Memory, I/O and IRQ Table

Note: Cards using the same IRQ line and appearing in a shaded row are mutually exclusive.

IRQ	Device type	Shared memory address	I/O address	DMA channel
0	Internal Timer	—	0x040 – 0x043	—
1	Keyboard	—	0x060 – 0x06F	—
2	SMC Ethernet Card (16-bit)	0xDC000 – 0xDFFFF	0x240 – 0x25F	—
2	Madge Smart AT Plus Token Ring Card	—	0x0A20	6
3	Serial Port 2 (25-pin)	—	0x2F8 – 0x2FF	—
4	Serial Port 1 (9-pin)	—	0x3F8 – 0x3FF	—
5	D/41ESC (4-port) Ch 00-23	0xD0000 – 0xD1FFF	—	—
5	Dialogic D/240SC-T1 Ch 00 – 23	0xD0000 – 0xD7FFF	0x340 – 0x343	—
5	D/320SC	0xD0000 – 0xD7FFF	—	—
6	Floppy Drive	—	0x1F0 – 0x1F7	2
7	Parallel Port	—	0x378 – 0x37F	—
8	Clock/Calendar	—	0x070 – 0x07F	—
9	—	—	—	—
10	Dialogic D/121B Ch 00 – 11	0xD0000 – 0xD5FFF	0x340 – 0x343	—
10	Dialogic D/81A Ch 00 – 07	0xD000 – 0xD3FFF	0x340 – 0x343	—
10	VCS VRP	0xD8000 – 0xD9FFF	0x200 – 0x203	—
11	SCSI Controller	0xCC000 – 0xCFFFF	0x330 – 0x333	5

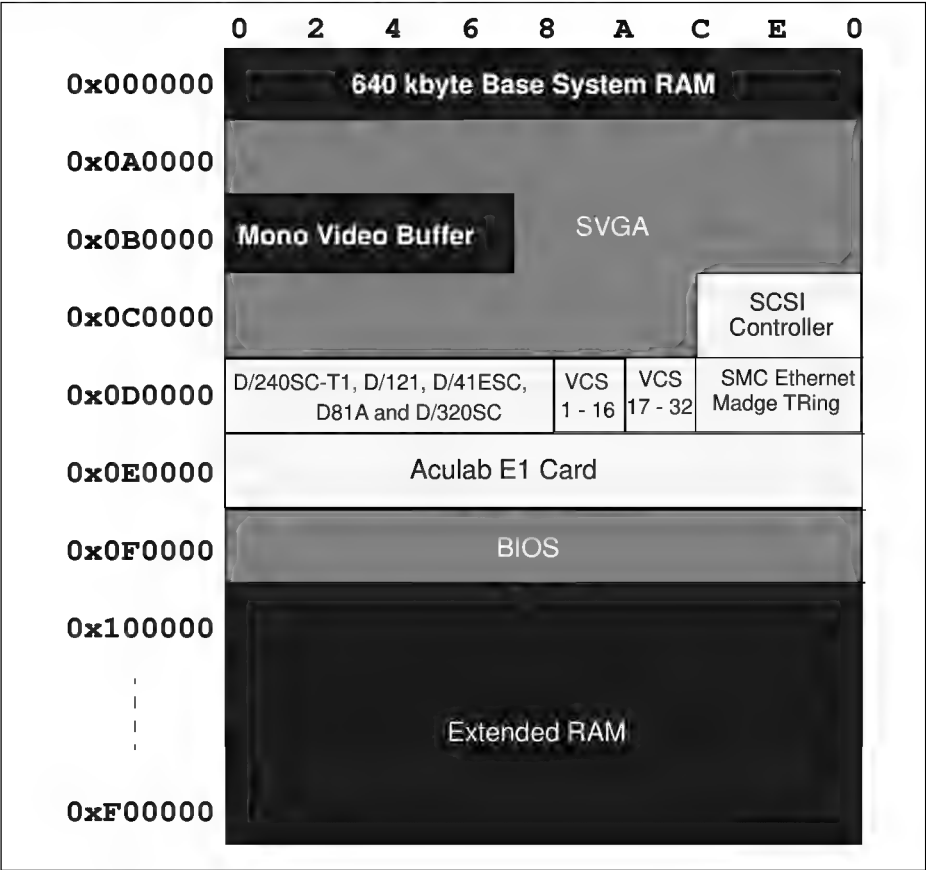
IRQ	Device type	Shared memory address	I/O address	DMA channel
12	Antares TTS Card Ch 00 – 15	—	0x210 – 0x217	—
14	Brooktrout Fax TR114-I2P Ch 00 – 01	—	0x120 – 0x12B	—
14	Brooktrout Fax TR114-I4P Ch 00 – 03	—	0x120 – 0x133	—
14	Brooktrout Fax TR114-I8P Ch 00 – 07	—	0x120 – 0x143	—
15	Dialogic D/240SC-T1 Ch 00 – 23	0xD0000 – 0xD7FFF	0x320 – 0x323	—
15	Aculab E1 Card (30 and 60 port)	0xE0000 – 0xEFFFF	0x320 – 0x323	-
—	Display Panel Controller	—	0x300 – 0x30F	—
N/A	640 kbyte System RAM	0x00000 – 0x9FFFF	—	—
N/A	Mono Video Buffer	0xB0000 – 0xB7FFF	—	—
N/A	BIOS and Basics	0xF0000 – 0xFFFFF	—	—
N/A	Extended RAM	0x100000 – 0xFDFFFF	—	—

8-28 System configuration**Table 8-19: Memory, I/O, and IRQ settings for multiple boards of the same type on an MRS**

Device type	IRQ	Shared memory address	I/O address	DMA channel
Dialogic D/240SC-T1 ch 00-23	5 15	0xD0000-0xD5FFF	0x340-0x343 0x320-0x323	—
Dialogic D/240SC-T1 ch 24-47	5 15	0xD0000-0xD5FFF	0x344-0x347 0x324-0x327	—
Dialogic D/121B ch 00-11	10	0xD0000-0xD5FFF	0x340-0x343	—
Dialogic D/121B ch 12-23	10	0xD0000-0xD5FFF	0x344-0x347	—
Dialogic D/121B ch 24-35	10	0xD0000-0xD5FFF	0x348-0x34B	—
Dialogic D/121B ch 36-47	10	0xD0000-0xD5FFF	0x34C-0x34F	—
Dialogic D/81A ch 00-07	10	0xD0000-0xD3FFF	0x340-0x343	—
Dialogic D/81A ch 08-15	10	0xD0000-0xD3FFF	0x344-0x347	—
Dialogic D/81A ch 16-23	10	0xD0000-0xD3FFF	0x348-0x34B	—
Dialogic D/81A ch 24-31	10	0xD0000-0xD3FFF	0x34C-0x34F	—
Dialogic D/81A ch 32-39	10	0xD0000-0xD3FFF	0x350-0x353	—
Dialogic D/81A ch 40-47	10	0xD0000-0xD3FFF	0x354-0x357	—
Dialogic D/320SC ch 00-29	5	0xD0000-0xD7FFF	—	—
Dialogic D/320SC ch 30-59	5	0xD0000-0xD7FFF	—	—
Dialogic D/41ESC (4 port) ch 00-23	5	0xD0000-0xD1FFF	—	—
VCS VRP card #1	10	0xD8000-0xD9FFF	0x200-0x203	—
VCS VRP card #2	10	0xDA000-0xDBFFF	0x204-0x207	—
Antares TTS card ch 00-15	12	—	0x210-0x217	—
Antares TTS card ch 16-31	12	—	0x218-0x21F	—
Antares TTS card ch 32-47	12	—	0x220-0x227	—
Antares TTS card ch 48-63	12	—	0x228-0x22F	—

Device type	IRQ	Shared memory address	I/O address	DMA channel
Brooktrout Fax TR114-I2P ch 00-01	14	—	0x120-0x12B	—
Brooktrout Fax TR114-I2P ch 02-03	14	—	0x148-0x153	—
Brooktrout Fax TR114-I2P ch 04-05	14	—	0x170-0x17B	—
Brooktrout Fax TR114-I2P ch 06-07	14	—	0x198-0x1A3	—
Brooktrout Fax TR114-I2P ch 08-09	14	—	0x1C0-0x1CB	—
Brooktrout Fax TR114-I2P ch 10-11	14	—	0x210-0x21B	—
Brooktrout Fax TR114-I4P ch 00-03	14	—	0x120-0x133	—
Brooktrout Fax TR114-I4P ch 04-07	14	—	0x148-0x15B	—
Brooktrout Fax TR114-I4P ch 08-11	14	—	0x170-0x183	—
Brooktrout Fax TR114-I4P ch 12-15	14	—	0x198-0x1AB	—
Brooktrout Fax TR114-I4P ch 16-19	14	—	0x1C0-0x1D3	—
Brooktrout Fax TR114-I4P ch 20-23	14	—	0x210-0x223	—
Brooktrout Fax TR114-I8P ch 00-07	14	—	0x120-0x143	—
Brooktrout Fax TR114-I8P ch 08-15	14	—	0x148-0x16B	—
Brooktrout Fax TR114-I8P ch 16-23	14	—	0x170-0x193	—
Brooktrout Fax TR114-I8P ch 24-31	14	—	0x198-0x1BB	—
Brooktrout Fax TR114-I8P ch 32-39	14	—	0x1C0-0x1E3	—
Brooktrout Fax TR114-I8P ch 40-47	14	—	0x210-0x233	—

Figure 8-13: MRS/Tower/Rack Shared Memory Map



Memory requirements for base processes

The tables in this section show the memory requirement of the Nortel IVR 2.5/S base processes. Only the static memory requirements are shown; the dynamically allocated memory is not shown in this table. The following are descriptions of each of the columns in the memory requirement tables:

- *Program* column shows the name of the process.
- *Memory requirements* column shows the amount of memory that each program uses in bytes. *Virtual* column shows the amount of memory the program initially requests at start-up. *Allocated* column shows the actual amount of memory that the program uses once it is started.
- *Class* column shows the nature of the process. A transient process is one which remains in memory for a short period of time. A static program remains in memory at all times.
- *Points* column shows the amount of memory each program uses. The points system is described in the subsequent section.
- *Comment* column gives a more detailed description of the program.

Tables

For AP base process memory requirements, see Table 8-20 on 8-32.

For MRS base process memory requirements, see Table 8-21 on 8-36.

For MRS/AP base process memory requirements, see Table 8-22 on 8-38.

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Table 8-20: Process memory requirements for AP

Note: The statement “Not measurable” in the Memory requirements column, which is entered for certain processes, indicates that those processes remain in memory for a very short period of time and are not easily measured.

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
Generation and VRS processes					
adsi1	167936	80281	Static	2	Analog Display Systems Interface process
adsi2	172032	84377	Static	2	Analog Display Systems Interface process
adsi3	172032	84377	Static	2	Analog Display Systems Interface process
adsi4	172032	84377	Static	2	Analog Display Systems Interface process
adsi5	172032	84377	Static	2	Analog Display Systems Interface process
cli	1724416	1105920	Static	14	Call Logic Interpreter
cli_s	163840	155648	Static		Call Logic Interpreter Server
csc	196608	65536	Static	2	Call Scheduler
dbb	368640	184320	Static	3	Information and Message Database Server
fds			Static		Informix SQL Database Server
ids			Static		Ingres SQL Database Server
msg	102400	77824	Static	1	Inter-process Message Manager
ods			Static		Oracle SQL Database Server
pmg	1265664	118784	Static	7	Channel Pool Manager

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
qds	5980160	106496	Static	30	Database Manager/SQL Interface
sad	524288	167936	Static	4	System Application Daemon
sds			Static		SyBase SQL Database Server
trapGen			Static		SNMP Interface Process
trs	303104	118784	Static	3	Host Communications Manager
trsc	212992	137216	Static		Host Communications Child Process
trsl	126976	114688	Static	2	Host Communications Logger
ueh	135168	75776	Static	2	User Error Handler
vft	180224	180224	Static	2	MRS File Transfer
vip1	1431312	700416	Static	11	MRS Interface Process
vip2	1421612	1421312	Static	14	MRS Interface Process
vrn	589824	282624	Static	5	MRS Resource Manager
vrtd1	172032	112640	Static	2	Runtime Daemon
vrtd2	1064960	186368	Static	7	Runtime Daemon
vtk	143360	122880	Static	2	MRS Interface Process
aud	Not measurable		Transient		Audit Process
bup	131072	90112	Transient	2	Backup Utility Server
cbup	Not measurable		Transient		Curses Backup Utility Interface
cdf	Not measurable		Transient		Cell Scripting Language Compiler

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Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
cucb	Not measurable		Transient		Customizable User Cell Builder
dpnd	Not measurable		Transient		Dependency Creator
gmessage	Not measurable		Transient		Generate XCONSOLE Message
greset	Not measurable		Transient		Reset Statistics
logcp	Not measurable		Transient		Log File Compiler
plf + xterm	1034592	795162	Transient	9	Prompt Loading Facility
ptype	Not measurable		Transient		Prototype Tool
sai + xterm	1081344	676378	Transient	9	System Application Interface
sam	1339392	380928	Transient	9	System Application Monitor
sase	Not measurable		Transient		System Admin Script Executor
scm + xterm	925696	672282	Transient	8	System Configuration Manager
sde + xterm	925696	684570	Transient	8	System Database Editor
sectool	94208	54727	Transient	1	Security Tool Utility
smi	897024	672225	Transient	8	System Maintenance Interface
xai	1511424	1118208	Transient	13	X Windows Application Interface
xae	2936832	1953792	Transient	24	X Windows Application Editor
xbup	1458176	1044480	Transient	13	X Windows Backup Utility Interface
xpm	1699840	1372160	Transient	15	X Windows Prompt Manager
uif	2297856	1269760	Transient	18	User Interface Manager

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
UPS processes					
Xpowerchute	118784	81556	Transient	1	UPS Gui interface
_xpwrchute	2523126	1560576	Transient	20	UPS Gui interface
_upsd	770048	156096	Static	5	UPS Daemon
_upsd	774144	774144	Static	8	UPS Daemon
SSI Processes					
agent	471040	209498	Static	4	SSI agent process
cdmserver	303104	295514	Static	3	SSI process
executive	577536	320090	Static	5	
watchdog	204800	168536	Static	2	
express	98304	60969	Transient	1	Express Manager process
CM	1470464	1905193	Transient	17	Configuration utility process
CFG	1904640	1487386	Transient	17	Control communications and diagnostics process

Table 8-21: Process memory requirements for MRS

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
Generation and VRS processes					
acm	368640	342016	Static	4	Aculab E1 Interface Manager
atts	303104	282624	Static	3	Dialogic Antares TTS Interface Manager
bas	192512	135168	Static	2	System Health Monitor
bri			Static		Promptus Binary Rate Interface
conv	143360	126976	Static	2	Facsimile Conversion Process
dcm (an extra dcm is required per 12 channels)	786432	342016	Static	6	Dialogic Channel Manager
dtm	352256	245760	Static		Dialogic T1 Interface Manager
hwm1	163840	104448	Static	2	Hardware Latch Manager
hwm2	155648	92160	Static	2	Hardware Latch Manager
msg	102400	86016	Static	1	Inter-process Message Manager
psm	2125824	1564672	Static	19	Port Status Manager
trapGen			Static		SNMP Interface Process
uvm	180224	135168	Static	2	Unix Volume Manager
vcs	364544	258048	Static	4	VCS Speech Recognition Manager
vpr4			Static		VPC Speech Recognition Manager

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
vrtd1	167936	77824	Static	2	Runtime Daemon
vrtd2	1019904	933888	Static	10	Runtime Daemon
vrtd3	167936	77824	Static	2	Runtime Daemon
vrtd4	172032	81920	Static	2	Runtime Daemon
vvm			Static		Disk Mirroring Volume Manager
sci	401408	151552	Transient	3	System Console Interface
UPS processes					
Xpowerchute	118784	81556	Transient	1	UPS Gui interface
_xpwrchute	2523126	1560576	Transient	20	UPS Gui interface
_upsd	770048	156096	Static	5	UPS Daemon
_upsd	774144	774144	Static	8	UPS Daemon

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Table 8-22: Process memory requirements for MRS/AP

Note: The statement “Not measurable” in the Memory requirements column, which is entered for certain processes, indicates that those processes remain in memory for a very short period of time and are not easily measured.

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
Generation and VRS processes					
acm	368640	342016	Static	4	Aculab E1 Interface Manager
ads1	167936	80281	Static	2	Analogue Display Systems Interface process
ads2	172032	84377	Static	2	Analogue Display Systems Interface process
ads3	172032	84377	Static	2	Analogue Display Systems Interface process
ads4	172032	84377	Static	2	Analogue Display Systems Interface process
ads5	172032	84377	Static	2	Analogue Display Systems Interface process
atts	303104	282624	Static	3	Dialogic Antares TTS Interface Manager
bas	192512	135168	Static	2	System Health Monitor
bri			Static		Promptus Binary Rate Interface
cli	1724416	1105920	Static	14	Call Logic Interpreter
cli_s	163840	155648	Static		Call Logic Interpreter Server
conv	143360	126976	Static	2	Facsimile Conversion Process
csc	196608	65536	Static	2	Call Scheduler

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
dcm (an extra dcm is required per 12 channels)	786432	342016	Static	6	Dialogic Channel Manager
dbs	368640	184320	Static	3	Information and Message Database Server
dtm	352256	245760	Static		Dialogic T1 Interface Manager
fds			Static		Informix SQL Database Server
hwm1	163840	104448	Static	2	Hardware Latch Manager
hwm2	155648	92160	Static	2	Hardware Latch Manager
ids			Static		Ingres SQL Database Server
msg	102400	86016	Static	1	Inter-process Message Manager
ods			Static		Oracle SQL Database Server
pmg	1265664	118784	Static	7	Channel Pool Manager
psm	2125824	1564672	Static	19	Port Status Manager
qds	5980160	106496	Static	30	Database Manager / SQL Interface
sad	524288	167936	Static	4	System Application Daemon
sds			Static		SyBase SQL Database Server
trapGen			Static		SNMP Interface Process
trs	303104	118784	Static	3	Host Communications Manager
trsc	212992	137216	Static		Host Communications Child Process

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Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
trsl	126976	114688	Static	2	Host Communications Logger
ueh	135168	75776	Static	2	User Error Handler
uvm	180224	135168	Static	2	Unix Volume Manager
vcs	364544	258048	Static	4	VCS Speech Recognition Manager
vft	180224	180224	Static	2	MRS File Transfer
vip1	1431312	700416	Static	11	MRS Interface Process
vip2	1421612	1421312	Static	14	MRS Interface Process
vpr4			Static		VPC Speech Recognition Manager
vrn	589824	282624	Static	5	MRS Resource Manager
vrtd1	172032	112640	Static	2	Runtime Daemon
vrtd2	1019904	933888	Static	10	Runtime Daemon
vrtd3	167936	77824	Static	2	Runtime Daemon
vrtd4	172032	81920	Static	2	Runtime Daemon
vrtd5	167936	77824	Static	2	Runtime Daemon
vrtd6	1064960	186368	Static	7	Runtime Daemon
vtk	143360	122880	Static	2	MRS Interface Process
vtek			Static		License Manager Interface
vvm			Static		Disk Mirroring Volume Manager
aud	Not measurable		Transient		Audit Process
bup	131072	90112	Transient	2	Backup Utility Server

Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
cbup	Not measurable		Transient		Curses Backup Utility Interface
cdf	Not measurable		Transient		Cell Scripting Language Compiler
cucb	Not measurable		Transient		Customizable User Cell Builder
dpnd	Not measurable		Transient		Dependency Creator
gmessage	Not measurable		Transient		Generate XCONSOLE Message
greset	Not measurable		Transient		Reset Statistics
logcp	Not measurable		Transient		Log File Compiler
plf + xterm	1034592	795162	Transient	9	Prompt Loading Facility
ptype	Not measurable		Transient		Prototype Tool
sai + xterm	1081344	676378	Transient	9	System Application Interface
sam	1339392	380928	Transient	9	System Application Monitor
sase	Not measurable		Transient		System Admin Script Executor
sci	401408	151552	Transient	3	System Console Interface
scm + xterm	925696	672282	Transient	8	System Configuration Manager
sde + xterm	925696	684570	Transient	8	System Database Editor
sectool	94208	54727	Transient	1	Security Tool Utility
smi	897024	672225	Transient	8	System Maintenance Interface
xai	1511424	1118208	Transient	13	X Windows Application Interface

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Program	Memory requirements (bytes)		Class	Points	Comment
	Virtual	Allocated			
xae	2936832	1953792	Transient	24	X Windows Application Editor
xbup	1458176	1044480	Transient	13	X Windows Backup Utility Interface
xpm	1699840	1372160	Transient	15	X Windows Prompt Manager
uif	2297856	1269760	Transient	18	User Interface Manager
UPS processes					
Xpowerchute	118784	81556	Transient	1	UPS Gui interface
_xpwrchute	2523126	1560576	Transient	20	UPS Gui interface
_upsd	770048	156096	Static	5	UPS Daemon
_upsd	774144	774144	Static	8	UPS Daemon
SSI Processes					
agent	471040	209498	Static	4	SSI agent process
cdmserver	303104	295514	Static	3	SSI process
executive	577536	320090	Static	5	
watchdog	204800	168536	Static	2	
express	98304	60969	Transient	1	Express Manager process
CM	1470464	1905193	Transient	17	Configuration utility process
CFG	1904640	1487386	Transient	17	Control communications and diagnostics process

Memory sizing for features and capacity

Memory is an important factor limiting the capacity and feature set of Nortel IVR 2.5/S systems.

The following “point system” can be used to determine which combinations of features and capacity will fit on a Nortel IVR 2.5/S system. The points are based on total system memory (1 point = 100 kbyte). Note that this point system is not intended to accurately predict the free memory for the system, but rather to predict which combinations of features can be installed before exhausting available memory on the system. The values in the tables are derived from measurements on the Nortel IVR 2.5/S.

Note: Additional physical memory may be required when swapping of more than the “Total Permitted Swapping” (as the values indicated in the tables below) disk space occurs. Frequent swapping of more than the “Total Permitted Swapping” amount for a long period of time, which can be recognized by an abnormally slow system, will require adding more physical memory. This is applicable to the AP, and MRS/AP. To determine a system’s swapping statistics, refer to the *SCO Open Desktop/SCO Open Server System Administrator’s Guide*.

Tables

For AP memory requirements, see Table 8-23 on 8-44.

For MRS memory requirements, see Table 8-24 on 8-45.

For MRS/AP memory requirements, see Table 8-25 on 8-46.

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Table 8-23: Memory requirements for the AP

	Amount of memory in system (Mbyte)		
	32	64	96
Total Permitted Swapping	72	72	72
Total Physical Memory	328	656	984
Operating System	63	63	63
Total available points	337	665	993
Core IVR processes			
IVR (Core Development/Run Time)	160/122	160/122	160/122
IVR Ports	1 per 6 channels		
Host Option (Core)	28	28	28
Host sessions (3270, VT100 and 5250) H = 3 if number of sessions = 4, or 8 H = 6 if number of sessions = 16 H = 12 if number of sessions = 32 H = 21 if number of sessions = 64	H	H	H
Core CCIP	53	53	53
CCIP usage per channel	0.2	0.2	0.2
Each agent monitored by CCIP	0.1	0.1	0.1
UPS Option	21	21	21
SQL Database (Local or remote) ^a	100	100	100
ADSI Option	10	10	10
User Functions ^b			

a. This is a typical SQL Database memory requirement.

b. To determine the User Functions memory requirements, find what resources the user function uses and then refer to the *SCO Open Desktop/SCO Open Server System Administrator's Guide*.

Table 8-24: Memory requirements for the MRS

	Amount of memory in system (Mbyte)
	32
Total Permitted Swapping	72
Total Physical Memory	328
Operating System	112
Total Available Points	288
Core IVR processes	
IVR (Core)	51
IVR Ports	6 per 12 channels
UPS Option	13
Aculab E1 Option (per card)	4
Antares TTS Option (per card)	3
Fax Option (per card)	2
T1 Option (per card)	4
Voice Recognition Option (per card)	4
Disk Mirroring Option ^a	10

a. Disk Mirroring Option applies only to MRS/Rack/Tower.

Table 8-25: Memory requirements for the MRS/AP

	Amount of memory in system (Mbyte)		
	32	64	96
Total Permitted Swapping	42	42	42
Total Physical Memory	328	656	984
Operating System	102	102	102
Total available points	268	596	924
Core IVR processes			
IVR (Core Development/Run Time)	211/172	211/172	211/172
IVR Ports	1 per channel		
UPS Option	21	21	21
Host Option (Core)	28	28	28
Host sessions (3270, VT100 and 5250) H = 3 if number of sessions = 4, or 8 H = 6 if number of sessions = 16 H = 12 if number of sessions = 32 H = 21 if number of sessions = 64	H	H	H
Core CCIP	53	53	53
CCIP usage per channel	0.2	0.2	0.2
Each agent monitored by CCIP	0.1	0.1	0.1
SQL Database (Local or remote) ^a	100	100	100
ADSI Option	10	10	10
Aculab E1 Option (per card)	4	4	4
Antares TTS Option (per card)	3	3	3
Fax Option (per card)	2	2	2
T1 Option (per card)	4	4	4

Voice Recognition Option (per card)	4	4	4
User Functions ^b			

a. This is a typical SQL Database memory requirement.

b. To determine the User Functions memory requirements, find what resources the user function uses and then refer to the *SCO Open Desktop/SCO Open Server System Administrator's Guide*.

Power consumption of the AP

Table 8-26: Power consumption calculation for the AP

Board/Peripheral	Current in amperes				
	+3.3V	+5V	-5V	+12V	-12V
System Baseboard and CPU		10.0A		0.06A	0.06A
Cooling fan (for two)				0.6A	
3.5-inch floppy drive		0.5A			
1.2 Gbyte SCSI hard drive		0.70A		0.38A	
Second 1.2 Gbyte drive		0.70A		0.38A	
Third 1.2 Gbyte drive		0.70A		0.38A	
Fourth 1.2 Gbyte drive		0.70A		0.38A	
2.5 Gbyte tape drive		1.0A		2.0A	
PCI Slot: ZNYX Ethernet Card ^a		1.2A			
EISA Slot: ISA Token-Ring LAN Card		1.10A			
EISA Slot: ISA Token-Ring Host Card		1.10A			
Apertus Host Connectivity (RS-232)		0.75A		0.04A	0.04A
Digiboard (PC/Xe card)		1.8A		0.130A	0.110A
Digiboard (PC/Xem card)		1.4A			
Total amperes used		17.3A		4.31A	0.17A
Total available amperes	32.0A	40.0A	0.5A	17.0A	1.0A
Watts used		86.5		51.72	2.04
Maximum TOTAL wattage (Maximum should be lower then 524W)^b		140.26			

a. Cards in the shaded rows are mutually exclusive. The card with the maximum power consumption has been used to calculate the total power consumption

b. An AP uses the maximum wattage with the following configuration: four hard disks, a ZNYX ethernet card, and a Digiboard PC/8e card.

Power consumption of the MRS/Tower or MRS/Rack

Table 8-27: Power consumption calculation for the MRS

Board/Peripheral	Current in amperes				
	+3.3V	+5V	-5V	+12V	-12V
CPU Board (486-66 with 32 Mbyte of RAM)		2.7A		0.10A	0.10A
Display Panel Controller		1.00A			
Serial I/O Controller Board		0.75A			
SCSI Controller Board		0.51A			
3x80 cfm Cooling fans				0.9A	
3.5-inch floppy drive		0.5A			
1.2 Gbyte SCSI hard drive		0.65A		0.4A	
Second 1.2 Gbyte drive		0.65A		0.4A	
ISA Slot: Loopstart Interface (LSI/120) ^a		0.5A		0.125A	0.125A
Loopstart Interface (LSI/80)		0.5A		0.125A	0.125A
E1 Interface (Aculab E1)		1.0A			
T1 Interface (D/240SC-T1)		4.3A		0.020A	0.020A
Loopstart Interface (D/41ESC)		1.25A		0.085A	0.085A
ISA Slot: 12 Ports Voice (D/121B)		2.5A			
8 ports Voice (D/81A)		2.5A			
D/320SC		4.4A		0.020A	0.020A
ISA Slot:2 Port Fax (TR114-I2P)		1.2A		0.05A	0.05A
ISA Slot:4 Port Fax (TR114-I4P)		1.8A		0.075A	0.075A
ISA Slot:8 Port Fax (TR114-I8P)		3.2A		0.150A	0.150A
ISA Slot: 16 port ASR (VRP) D= Number of 4 or 2 port daughter boards (VRM/40, VRM/2C)		2.0+0.31 *(D) A			

8-50 System configuration

Board/Peripheral	Current in amperes				
	+3.3V	+5V	-5V	+12V	-12V
ISA Slot: Antares 2000 (TTS)		2.4A		0.020A	0.020A
ISA Slot: SMC Ethernet Card		1.2A			
ISA Slot: ISA Token-Ring LAN Card		1.10A			
Total amperes used		21.19		1.99A	0.29A
Total available amperes	32.0A	40.0A	0.5A	17.0A	1.0A
Watts used		105.95		23.88	3.48
Maximum TOTAL wattage (Maximum should be lower then 524W)		133.31			

- a. Cards in the shaded rows are mutually exclusive. The card with the maximum power consumption has been used to calculate the total power consumption.

Power consumption of the MRS/AP

Table 8-28: Power consumption calculation for the MRS/AP

Board/Peripheral	Current in amperes				
	+3.3V	+5V	-5V	+12V	-12V
System Baseboard and CPU		10.0 A		0.06A	0.06A
Cooling fan (for two)				0.6A	
3.5-inch floppy drive		0.5A			
1.2 Gbyte SCSI hard drive		0.70A		0.38A	
Second 1.2 Gbyte drive		0.70A		0.38A	
2.5 Gbyte tape drive		1.0A		2.0A	
EISA Slot: Loopstart Interface (LSI/120) ^a		0.5A		0.125A	0.125A
Loopstart Interface (LSI/80)		0.5A		0.125A	0.125A
E1 Interface (Aculab E1)		1.0A			
T1 Interface (D/240SC-T1)		4.3A		0.020A	0.020A
Loopstart Interface (D/41ESC)		1.25A		0.085A	0.085A
EISA Slot: 12 Ports Voice (D/121B)		2.5A			
8 ports Voice (D/81A)		2.5A			
D/320SC		4.4A		0.020A	0.020A
EISA Slot: 2 Port Fax (TR114-I2P)		1.2A		0.05A	0.05A
EISA Slot: 4 Port Fax (TR114-I4P)		1.8A		0.075A	0.075A
EISA Slot: 8 Port Fax (TR114-I8P)		3.2A		0.150A	0.150A
EISA Slot: 16 port ASR (VRP) *D= Number of 4 or 2 port daughter boards (VRM/40, VRM/2C)		2.0+0.31 *(D) A			
EISA Slot: Antares 2000 (TTS)		2.4A		0.020A	0.020A

8-52 System configuration

Board/Peripheral	Current in amperes				
	+3.3V	+5V	-5V	+12V	-12V
PCI Slot: ZNYX Ethernet Card		1.2A			
EISA Slot: ISA Token-Ring LAN Card		1.10A			
EISA Slot: ISA Token-Ring Host Card		1.10A			
Apertus Host Connectivity board (RS-232)		0.75A		0.04A	0.04A
Digiboard (PC/Xe card)		1.8A		0.130A	0.110A
Digiboard (PC/Xem card)		1.4A			
Total amperes used		35.50A		4.06A	0.70A
Total available amperes	32.0A	40.0A	0.5A	17.0A	1.0A
Watts used		177.5		48.72	8.40
Maximum TOTAL wattage (Maximum should be lower then 524W)^b		234.62			

a. Cards in the shaded rows are mutually exclusive. The card with the maximum power consumption has been used to calculate the total power consumption.

b. An MRS/AP uses the maximum wattage with the following configuration: two hard disks, a ZNYX ethernet card, two D/240SC-T1 cards, and four Brooktrout TR114-I8P fax cards.

Chapter 9: CCIP engineering

Introduction

Call Centre Integration Package (CCIP) provides a greater level of integration with the Meridian 1 PBX to allow application developers to build sophisticated Call Centre Applications. CCIP is a separately purchasable option of Nortel IVR 2.5/S.

Hardware and software requirements

Hardware requirements

- M1 switch
- Meridian Link (AEM or IPE Model)
- MRS/AP or MRS and AP

Software requirements

- Meridian 1 X11 Release 22.x and higher
- Meridian Link 5.04 and higher with TCP/IP
- Nortel IVR 2.01/S or Nortel IVR 2.5/S
- Visual TCL 1.00 (included on the CCIP tape)
- CCIP 1.00
- Special Trunk file for Line Side T1

CCIP trunk files

The following table indicates the trunk type required for a specific type of telco interface.

Table 9-1: Trunk file versus M1 interfaces

Interface to M1	Trunk file used
Loop Start (LSI120/LSI80 and D41ESC)	Loop-B
Line Side T1	NT-FXS-T1-LS

CCIP kernel requirements

The following table indicates the kernel values that are increased for the CCIP package.

Table 9-2: Kernel parameter adjustments for CCIP

Kernel parameter	FROM	TO
NBLK256	300	700
NBLK64	400	900
NBLK1024	84	110

This increase in Kernel parameters cause the system to use 250 kbyte extra physical DRAM.

Disk space requirements

The following table indicates the CCIP disk requirements under various file systems on the AP and MRS/AP.

Table 9-3: CCIP disk space requirements for different file systems

Software	/root file system in Mbyte	/u file system in Mbyte
Visual TCL 1.00	5.969920	0
CCIP S/W	0	13.922816

CCIP core processes (transient and static)

Table 9-4: CCIP core processes

Process names	Description
ccipadmin.tcl	The admin tcl source code
ccipadmin.sh	A script which runs the admin tcl program
xm_vtcl	The SCO vtcl run-time interpreter
*system.exe	Started by the ccipadmin process and used for tracking the progress of timed events
dbengine.exe	The backbone database engine used for login backbone errors and reading and writing database information used by the backbone on startup.
wake_up.exe	A process used by the backbone to wake_up to read all queues. Used by backbone to keep track of timed events.
radini.exe	Process used by admin to read and write to the ccip.ini file. Configuration screen
rcccs.exe	Process used by admin to send requests to CCCS
chnlstat.exe	Process used by admin to request channel status (from links)
rcccs.exe	System status screen
ivrs	The CCIP IVRS server
cccs	The CCIP CCCS server
cciplogd	The CCIP log daemon-> used to log ccip error, history, and summary files through syslogd
datas	The CCIP DATAS server
acts	The CCIP ACTS server

9-4 CCIP engineering

Process names	Description
*links	The CCIP LINKS server-> spawns child process to receive messages from LINK. The child interprets these requests and translates them to CORBA messages and queues them to the parent. (That is why there are two processes.) The parent receives corba messages from the child and messages to other servers as required and responds back to LINK if required.
killccip.sh	A script file used to kill CCIP processes
adkill.sh	A script file used to kill the xm_vtcd daemon on exit of last CCIP Admin window
.ccipxfer	User function
.ccipconf	User function
.ccipinfo	User function
totxt	A user function used by the test program to write call info to a text file for verification purposes

* There is more than one occurrence of this process.

CCIP memory usage

Memory is an important factor limiting the capacity and feature set of Nortel IVR 2.5/S.

The following “point system” can be used to determine the CCIP memory usage only. The points are based on total system memory (1 point = 100 kbyte). Note that this point system is not intended to accurately predict the free memory for the system, but rather to predict which combinations of features can be installed before exhausting available memory on the system.

Note: Additional physical memory may be required when swapping of more than the “Total Permitted Swapping” disk space occurs (see “Memory sizing for features and capacity” in Chapter 8). Frequent swapping of more than the “Total Permitted Swapping” amount for a long period of time, which can be recognized by an abnormally slow system, will require adding more physical memory. This applies to the AP and MRS/AP. To determine a system’s swapping statistics, refer to the *SCO Open Desktop/SCO Open Server System Administrator’s Guide*.

Memory usage (Allocated and Unshared) per CCIP process

Table 9-5: Allocated and Unshared Memory usages for the CCIP processes

Process name	Allocated	Unshared
ccipadmin.tcl	425984	401408
ccipadmin.sh	102985	53248
syslime.exe	40960	24576
syslime.exe	217088	86016
datas	311296	98304
dbengine.exe	245760	73728
acts	372736	122880
links	299008	139264
wake_up.exe	94208	45056

Process name	Allocated	Unshared
ivrs	319488	98304
cccs	339968	106496
cciplogd	602112	548864
links	299008	139264
radini.exe	73728	32768
rcccs.exe	155648	53248
chnlstat.exe	122880	45056
rcccs.exe	155648	53248
.ccipxfer	413696	176128
totxt	200704	77824
.ccipconf	413696	176128
.ccipinfo	413696	176128
xm_vtcd	1306624	438272
killccip.sh		49152
adkill.sh		49152

Core memory usage calculation

The core memory used is calculated according to the following formula:

Core Memory Used = (Allocate memory usage - Unshared memory Usage)/2
+ Unshared memory usage + Kernel increase usage =
(6926921-3166208)/2 + 3166208 + 250000 = 5296564.5 bytes

Capacity factor calculation

The following indicates growth of some of the CCIP process due to the load factor.

Every IVR channel = 20 kbyte

Every monitored agent by CCIP = 10 kbyte

Summary table

Table 9-6: Summary of memory usage

Description		Points
Core CCIP memory usage		53
Each IVR channel memory usage I= 1 for every 5 IVR channels	20 kbyte	0.2 I
Every Monitored agents by CCIP A= 1 for every 10 monitored agents	10 Kbyte	0.1 A

Memory sizing

The following example demonstrates the memory required for CCIP. This is in addition to what you might require for other IVR features such as fax, and voice recognition.

Example

A customer requires the CCIP package running on 24 IVR channels and they want to monitor 200 agent sets.

Total memory in points = 53 points (Core CCIP Memory usage) + 5 points (IVR channels) + 20 points (monitored agent)= 78 points

LAN connectivity

LAN connection between CCIP (AP) and Meridian Link

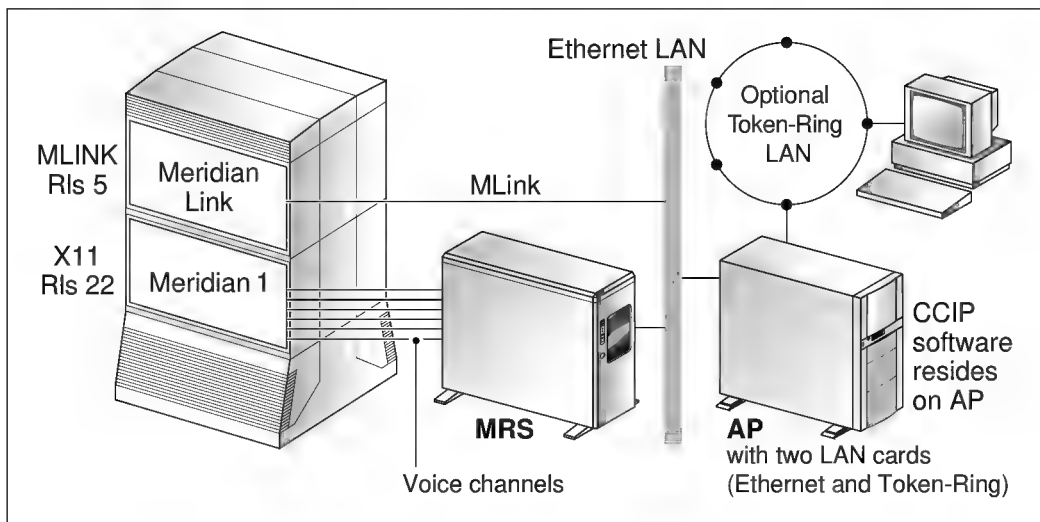
AP (or MRS/AP) and Meridian Link should exist on the same LAN. This means there should not be any LAN bridges or gateways between the AP and Meridian Link. The throughput of an Ethernet LAN is highest with small traffic (minimum number of packet collisions), but deteriorates rapidly as traffic on the LAN increases.

The AP (with CCIP running on it) and MRS do not need to be on a dedicated LAN. But it is recommended that the AP (running the CCIP) be on a dedicated LAN if the traffic on the already-existing LAN is high. A lot of traffic on the LAN can significantly reduce the performance of the CCIP and IVR system.

Token Ring considerations

Meridian Link does not support Token Ring connectivity. As a result, when the connection between the MRS and the AP is over a Token Ring LAN, an additional Ethernet card in the AP is required for Meridian Link connectivity.

Figure 9-1: Meridian Link connection to an IVR system with a Token-Ring LAN

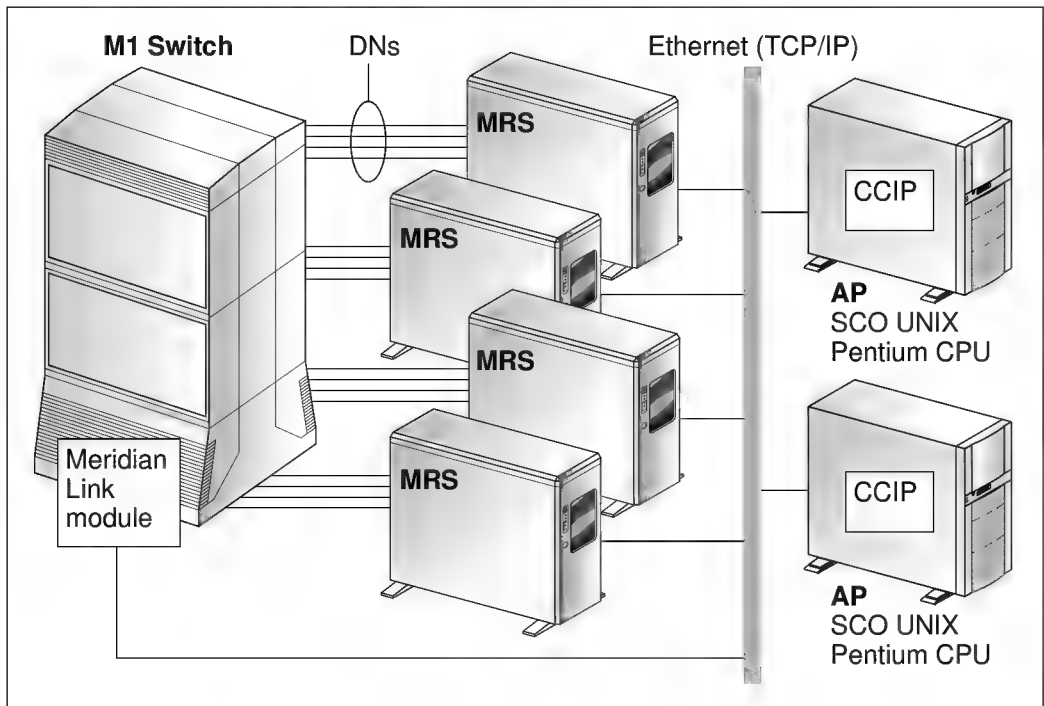


Networked CCIP considerations

In this scenario, every AP should be running a separate copy of the CCIP software. It is important to know that multiple copies of CCIP could monitor the same DN. The maximum number of CCIP applications per AP or CCIP plus any other Link applications (TAPI and so on) is 16 per Meridian LINK module.

See Figure 9-2 for connectivity information.

Figure 9-2: Multiple CCIPs and APs connectivity diagram



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Traffic and engineering principles

See Chapter 14, "Traffic and engineering principles" for Nortel IVR 2.5/S traffic and engineering principles.

Chapter 10: Slot allocation

Introduction

The computer bus of the MRS/Tower and MRS/Rack is ISA. There are 20 ISA slots in the MRS/Rack and either 18 or 20 ISA slots in the MRS/Tower. The 20-slot backplane for the MRS/Tower has replaced the 18-slot backplane, effective December 1996.

The AP or MRS/AP computer bus has three PCI slots and six EISA/ISA slots. One of the slots is a hybrid slot that can be used for either a PCI card or an EISA/ISA card but not both at the same time. The hybrid slot is used as an ISA slot by Nortel IVR 2.5/S.

All ISA slots in either the MRS/Tower, MRS/Rack, or AP (MRS/AP) are identical. All PCI slots in the AP (MRS/AP) are identical. PEB cards can be plugged in any ISA slot subject to: PEB connectivity rules (see page 8-4), IRQ settings and constraints (see page 8-18 to page 8-26), and system constraints (Chapter 11).

Cards on any one PEB must have a contiguous slot allocation (for example, a card on PEB 2 must not be inserted in a slot between the first card and last card of PEB 1).

Slot assignments: AP

Table 10-1 shows the slot assignment in the Application processor.

Table 10-1: AP Base Slot Allocation

Slot type	Slot assignment
PCI-3 ^a	Ethernet Card (Empty if Token Ring LAN used)
PCI-2	Ethernet Card if CCIP is installed
PCI-1	Not Used
EISA-6	EISA slots 1-6 are used for a host connectivity card or a Token Ring LAN card
EISA-5	
EISA-4	
EISA-3	
EISA-2	
EISA-1	

a. One LAN card (Ethernet or Token Ring) is required in the AP. An additional Ethernet LAN card is required if CCIP is installed.

Note: The AP has a label inside the chassis indicating how the PCI and EISA slots are numbered.

Slot assignments: MRS

The tables in this section show the slot assignment in the different MRS platforms.

The 18-slot MRS/Tower uses the older backplane, which has been replaced by the newer 20-slot backplane, effective December 96.

Table 10-2: MRS/Tower Base Slot Allocation (18 slots)

Slot number	Module	Module description
Slot 1	CPU Module	CPU Module
Slot 2	Ethernet/Token Ring Card	SMC Ethernet Card or Madge Token Ring Card
Slot 3	Serial I/O Card	Print port and Port B
Slot 4	Serial I/O Card	Port A and Alarms
Slot 5-16	PEB cards	PEB cards include network interface, voice processing, voice recognition, text-to-speech, fax.
Slot 17	SCSI Disk Card	SCSI Disk Controller
Slot 18	Display Card	Display Controller

10-4 Slot allocation

Table 10-3: MRS/Tower Base Slot Allocation (20 slots)

Slot number	Module	Module description
Slot 1	CPU Module	CPU Module
Slot 2	Ethernet/Token Ring Card	SMC Ethernet Card or Madge Token Ring Card
Slot 3-16	PEB cards	PEB cards include network interface, voice processing, voice recognition, text-to-speech, fax.
Slot 17	Serial I/O	Print port and Port B
Slot 18	Serial I/O	Port A and Alarm
Slot 19	SCSI Disk Card	SCSI Disk Controller
Slot 20	Display Card	Display Controller

Table 10-4: MRS/Rack Base Slot Allocation

Slot number	Module	Module description
Slot 1	Serial I/O Card	2 serial ports and 1 printer port
Slot 2	CPU Module	CPU Module
Slot 3	Ethernet/Token Ring Card	SMC Ethernet Card or Madge Token Ring Card
Slot 4-18	PEB cards	PEB cards include network interface, voice processing, voice recognition, text-to-speech, fax.
Slot 19	SCSI Disk Card	SCSI Disk Controller
Slot 20	Display Card	Display Controller

Slot assignments: MRS/AP

Table 10-5 shows the slot assignment in the MRS/AP.

Since there are only six EISA slots available on the MRS/AP platform, it is recommended that the ZYNX PCI Ethernet Card be used for LAN connectivity.

Table 10-5: MRS/AP Base Slot Allocation

Slot type	Slot assignment
PCI-3 ^a	Ethernet Card (Empty if Token Ring LAN used)
PCI-2	Ethernet Card if CCIP is installed
PCI-1	Not Used
EISA-6	EISA slots 1-6 are used for PEB cards, host connectivity cards or Token Ring LAN card
EISA-5	
EISA-4	
EISA-3	
EISA-2	
EISA-1	

a. One LAN card (Ethernet or Token Ring) is required in the MRS/AP. An additional Ethernet LAN card is required if CCIP is installed.

Note: The MRS/AP has a label inside the chassis indicating how the PCI and EISA slots are numbered.

Chapter 11: System capacity

Capacity limits on the AP

Table 11-1: AP capacity limits

Item	Maximum number of cards per AP	Maximum number of ports per AP
Host connectivity		
3270 (SDLC)	1 board	64 sessions
3270 (Token Ring)	1 board	64 sessions
5250 (SDLC)	1 board	64 sessions
5250 (Token Ring)	1 board	64 sessions
VT100	1 board (1 X 8 port PC/Xe serial board, or 1 x 16 or 1 x 32 port PC/Xem serial board)	32 sessions
SQL databases (Informix, Oracle, Sybase and Ingres)		
SQL Database	50 simultaneous accesses to local or remote databases	
SQL Name Size	32 characters for name size of SQL	
User functions		
Number of User Functions	12 User Functions on the system	

11-2 System capacity

Item	Maximum number of cards per AP	Maximum number of ports per AP
Number of Processes per User Function	10 processes (children) per User Function	
Number of C Functions per Process	75	

Note: The number of boards inside the AP is limited by the number of available EISA/ISA slots in the AP. There are six available EISA/ISA slots when an ethernet LAN card is used, and five available EISA/ISA slots when a token ring LAN card is used.

Capacity limits on the MRS

Table 11-2: MRS capacity limits

Item	Maximum number of cards per MRS	Maximum number of ports per MRS
Telco boards		
Loopstart	4 LSI/120 cards (with D/121B cards)	48
	6 LSI/80 cards (with D/81A cards)	48
	12 D/41ESC cards	48
T1	4 D/240SC-T1 cards	96 ^a
E1 (30 ports)	1 Aculab E1 card (with D/320SC)	30
E1 (60 ports)	1 Aculab E1 card (with D/320SC)	60
Option cards		
Discrete Speech Recognition	2 VR/160 cards with VRM/40 daughterboards	32
Continuous Speech Recognition	2 VR/160 cards with VRM/2C daughterboards	16
Text to Speech	4 Antares cards	64 ^b
Fax	6 Brooktrout cards	48
PEB capacity limits		
Number of PEBs per system	2	n/a
Number of cards per PEB	10	n/a
Number of FAX cards per PEB	4	n/a
Number of ASR cards per PEB	2	n/a
Number of TTS cards per PEB	2	n/a

11-4 System capacity

Item	Maximum number of cards per MRS	Maximum number of ports per MRS
Number of option cards per PEB	7	n/a
Number of telco ports per PEB	24/32	n/a

- a. Performance of high capacity MRS/AP systems with 72 or 96 ports is dependent on call arrival distribution and IVR application specifics. Performance degradation can occur under unfavorable conditions.
- b. If the system uses a 60-port E1 Aculab card, the actual maximum number of TTS ports used is 60.

Note: The number of boards inside an MRS is limited by the number of slots available in the MRS. The following list indicates the number of slots available for option cards on the MRS:

MRS/Tower (18-slot backplane): 12

MRS/Tower (20-slot backplane): 14

MRS/Rack: 15

Capacity limits on MRS/AP

Table 11-3: MRS/AP capacity limits

Item	Max number of cards per MRS/AP	Max number of ports per MRS/AP
Telco boards		
Loopstart	3 LSI/120 cards (with D/121B cards)	36
	3 LSI/80 cards (with D/81A cards)	24
	6 D/41ESC cards	24
T1	4 D/240SC-T1 cards	96
E1 (30 ports)	1 Aculab E1 card (with D/320SC)	30
E1 (60 ports)	1 Aculab E1 card (with D/320SC)	60
Option cards		
Discrete Speech Recognition	2 VR/160 cards with VRM/40 daughterboards	32
Continuous Speech Recognition	2 VR/160 cards with VRM/2C daughterboards	16
Text to Speech	4 Antares cards	64 ^a
Fax	4 Brooktrout cards	32
Host connectivity		
3270 (SDLC)	1 board	64 sessions
3270 (Token Ring)	1 board	64 sessions
5250 (SDLC)	1 board	64 sessions
5250 (Token Ring)	1 board	64 sessions

11-6 System capacity

Item	Max number of cards per MRS/AP	Max number of ports per MRS/AP
VT100	1 board (1 X 8 port PC/Xe serial board or 1 x 16 port PC/Xem serial board)	16 sessions
SQL databases (Informix, Oracle, Sybase and Ingres)		
SQL Database	50 simultaneous accesses to local/ remote databases	
SQL Name Size	32 characters for name size of SQL	
User functions		
Number of User Functions	12 User Functions on the system	
Number of Processes per User Function	10 processes (children) per User Function	
Number of C Functions per Process	75	
PEB capacity limits		
Number of PEBs per system	2 (exception: 4 when using T1 telco interface)	
Number of cards per PEB	10	
Number of FAX cards per PEB	4	
Number of ASR cards per PEB	2	
Number of TTS cards per PEB	2	
Number of option cards per PEB	7	
Number of telco ports per PEB	24/32	

- a. The actual maximum number of TTS ports used is 48. In a T1 system, two TTS boards are allowed per PEB. In a 60 port E1 system, a total of 3 TTS boards are allowed per MRS/AP.

Chapter 12: System limitations

Limitations applicable to AP, MRS, and MRS/AP

Option Cards (MRS/AP or MRS)

- Fax, TTS, and VR ports on one PEB cannot be used by IVR ports on another PEB.

Voice Recognition (MRS/AP or MRS)

- Only one language can be used per PEB. A maximum of two languages can be used in the system, since only two ASR cards can be used in a system.
- Discrete and continuous ASR cannot be mixed on the same card.

Text-to-Speech (MRS/AP or MRS)

- Only one language can be used per PEB. A maximum of two languages can be used in the system.

Host Communication (AP or MRS/AP)

- Regardless of platform, AP or MRS/AP, only one type of host communication board can be used at a time. Only one instance of that type is supported.
- An MRS/AP with an Aculab card and a voice recognition card cannot at the same time use a Digiboard PC/Xem host communication board due to memory address conflicts.

Telco (MRS/AP or MRS)

- Telco interface cards cannot be mixed in the same MRS or MRS/AP. The following cards must always be used together: LSI/120 and D/121B, LSI/80 and D/81A, Aculab E1 and D/320SC.
- Only one instance of Aculab E1 card (30 ports or 60 ports) is supported.

CCIP (AP or MRS/AP)

- CCIP does not support connections to more than one Meridian Link at the same time.
- CCIP, UPS, and fax cannot all coexist in the MRS/AP. Only two of them can be configured in the MRS/AP.

CPU (AP, MRS/AP, or MRS)

- The CPUs supported are: 75, 100, and 133 MHz Pentium (on AP and MRS/AP).
- Dual processors on the AP and MRS/AP are not supported.
- The supported CPU on the MRS is Intel's 486 DX2/66 CPU.

RDBMS (MRS/AP or AP)

- Simultaneous use of more than one local or remote RDBMS, on the AP or MRS/AP is not supported.

Memory (AP and MRS/AP)

- Only 256 kbyte of burst cache is supported (AP and MRS/AP).
- AP and MRS/AP use a minimum of 32 Mbyte of RAM.
- The upper limit of onboard RAM on AP and MRS/AP is 96 Mbyte.
- 32 Mbyte SIMMs are not supported.
- Nortel IVR 2.5/S is configured with 1 Mbyte of Video DRAM (standard not expandable).
- For the most up-to-date approved and qualified DRAM and Video DRAM List, check with Intel Corporation.
- There are 4 memory banks on the AP and MRS/AP. Bank 0 must always be populated first.

Other

- 9.6, 14.4, 28.8, and 33.6 kbit/s modems are supported on the MRS/AP platform.
- 9.6, 28.8, and 33.6 kbit/s modems are supported on the MRS.
- Nortel IVR 2.5/S only supports network printers.
- A maximum of two telnet sessions are possible.
- Cards cannot share IRQs except when they are of the same type. Exceptions are the D/121B and D/81A cards which can share IRQ 10 with the VR/160 card.
- The following table shows A-law and μ -law support for the various telephony cards. (Option cards support both A-Law and μ -Law.)

Table 12-1: A-law and μ -law support

Card	Companding
D/41ESC	A-Law
LSI/120	μ -Law
LSI/80	μ -Law
D/240SC-T1	μ -Law
Aculab	A-Law

- Nortel IVR 2.5/S does not support redundant APs.
- Nortel IVR 2.5/S software does not support hot swappable hard disks, meaning hard disks cannot be swapped when IVR software is running.
- Disk mirroring is a feature that is not field upgradable.
- The simultaneous use of an IVR system for both development and run-time purposes is strongly discouraged.
- Nortel IVR 2.5/S supports the following North American system prompts: US-English, Spanish, and Canadian French.
- Nortel IVR 2.5/S supports the following International system prompts: UK-English, Italian, Dutch, Parisian French, Spanish, German, and Japanese.

AP limitations

- An AP may be combined with up to two MRS units.
- The AP supports up to four hard disks.
- A modem is not supported on the AP.

MRS/Rack and MRS/Tower limitations

- The MRS supports up to two hard disks in a disk mirroring configuration. Without disk mirroring, a maximum of three hard disks is supported.
- Nortel IVR 2.5/S does not support a redundant DC power supply for the MRS/Rack. Nortel IVR 2.01/S customers who have a redundant DC power supply will be supported.
- MRS RAM cannot be expanded.

MRS/AP limitations

- An MRS/AP using the T1, E1 or D/41ESC network cards has limitations on the type of option cards that can be present in the system. This limitation is due to the limited number of available IRQs. The following are IRQ assignments for these telephony cards: the T1 card uses IRQ 5 and 15, the E1 card uses IRQ 15 (the D/320SC voice processing card uses IRQ 5), and the D/41ESC card uses IRQ 5. As a result, there are only two IRQs available for option cards when using a T1 or E1 network card. They are IRQs 10 and 14. IRQ 10 can be used either by a text-to-speech (a text-to-speech card can only use an IRQ less than or equal to 12), voice recognition, or host connectivity card. IRQ 14 can be used by a fax card. When using the D/41ESC network card, IRQ 15 is available and can be used by a host connectivity card. As a result, the main limitation for an MRS/AP system using these network cards is that it cannot use a text-to-speech and a voice recognition card at the same time.
- The Digiboard PC/Xem host communication board cannot be used in an MRS/AP system with an Aculab E1 card and a voice recognition card, due to shared memory conflicts.
- The Madge Smart 16/4 Plus RN Host Card uses IRQ 15 by default. For high density T1 interface, with fax, but no voice recognition and TTS, the Madge Smart 16/4 Plus RN Host Card can use IRQ 10.
- A system with an Aculab E1 card and a voice recognition card cannot have a Digiboard PC/Xem or TTS board.

- MRS/AP supports a maximum of two hard disks.
- Disk mirroring is not supported on the MRS/AP.

Digit Tone Receiver limitations

It is important to engineer your switch for maximum DTR (if ACD log on or log off feature is used).

Minimum DTR (channels) = $1/3 \times$ number of agents on IVR

Chapter 13: System performance

Factors affecting system performance

Factors affecting system performance are imposed by a combination of the system limits and the nature of the running applications. It is recommended that the IVR applications be designed such that the response time is less than one second. Thus the system should respond with voice within one second after a DTMF digit or string of digits are entered.

Host access

This is a factor which is not directly related to IVR performance, but to the performance of the remote host and the quality of communications between the two machines. If host access is going to be longer than one second, it is recommended that the application play voice while the access is occurring.

LAN connection between AP and MRS

AP and MRS should be found on the same LAN. This means there should not be any LAN bridges or gateways between the AP and MRS. The throughput of an Ethernet LAN is highest with small traffic (minimum number of packet collisions), but deteriorates rapidly as traffic on the LAN increases. On the other hand, a Token Ring LAN has worse performance than Ethernet under lower traffic, but maintains a steady performance under heavy traffic.

The AP and MRS do not need to be on a dedicated LAN. But it is recommended that IVR be on a dedicated LAN if the traffic on the already existing LAN is high. High traffic on the LAN can significantly reduce the performance of the IVR system.

Chapter 14: Traffic and engineering principles

Traffic model

The traffic model used by an IVR system is dependent on how the front-end switch treats incoming calls. The IVR system provides a finite number of channels on which calls can be processed. If all the channels are busy, the switch can either block any other calls destined for the IVR system or it can queue up the calls. The latter model is used by all Open IVR systems fronted by a PBX. For systems fronted by a CO switch, using UCD queues calls while using the Multi-Line Hunt Group blocks calls. A PBX can also block calls by equating the number of incoming IVR trunks to the number of IVR channels.

Target grade of service

The Grade of Service (GOS) is simply the probability that a caller is queued beyond a certain amount of time, or the probability that a caller is blocked. A number of factors affect the Grade of Service:

- the call volume (for example, the number of calls in a busy hour)
- the average length of the calls
- the number of ports available to service these calls
- whether the ports are dedicated or shared

Factors 1 and 2 together make up the traffic intensity. For example, if an application expects 100 calls in the busy hour and each call lasts an average of two minutes, then the traffic intensity on that application is $100 * 120$ seconds, which is 12,000 call seconds or 120 centi-call seconds (120 ccs). Because the GOS is dependent on the call hold time, it is indirectly dependent on the response time characteristics of the application. An application with bottlenecks (for example, a slow external host) will lead to higher call hold times and hence a worse Grade of Service.

In a queueing traffic model, the recommended GOS is a 5% probability that the delay in the queue will exceed one ring cycle. This is known as a P.05 GOS. One ring cycle is approximately 6 seconds.

In a blocking traffic model, the recommended GOS is a 2% probability that a caller will be blocked. This is a P.02 GOS.

Target response times

While the GOS is not directly dependent on IVR CPU power, the response time is. In addition, if external factors like 3270 hosts are present, the response time becomes dependent on their response characteristics as well.

However, there is one response time which is always dependent on IVR. This is the time between when a caller finishes entering DTMF input and when the system responds by playing a prompt. This time should be less than 2 seconds 95% of the time and should average under 1 second. This target should be met even if the response time includes local data retrieval.

Fax Response traffic model

The Fax Response traffic model has both queueing and blocking. A pure queueing model is used for Call Back fax. The application initiates a Call Back request. The fax is queued up and sent out once it reaches the head of the queue and a fax modem becomes free.

The Same Call model is more complex. An application wishing to use Same Call fax first has to reserve a modem. It is recommended that the modem be reserved as close as possible to the time when it is to be used. If a reserved modem remains idle for more than 5 minutes, it is freed up by the system. The application can also specify a time it is willing to wait to reserve a modem. The Same Call model thus becomes:

- The blocking model if that time is set to zero

- The queuing with a time-out model if the time is not zero. The application dequeues if the time in queue reaches a threshold.

Target fax grade of service

The factors affecting Fax GOS are

- the number of faxes requested in a busy hour
- the average number of pages and their resolution
- the average rendering time per page
- the number of fax ports available

Fax rendering and sending are one operation to an IVR application. Therefore factors 2 and 3 will determine how long a fax port is held. Together with factor 1, this determines the fax traffic intensity.

The Fax GOS is important in a Same Call situation because the fax operation will take place on the same IVR call. The GOS is the probability that a fax modem does not become available in a certain time (which could be 0).

The target GOS for Call Back fax is a measure of the probability of a fax sitting in the queue waiting to go out exceeds a certain time. This is important when an IVR application promises to send a fax within a certain time.

Another factor which may affect Call Back fax is the probability that the remote machine is busy. If the fax is being sent with a retry option, it will be queued up again. For the purposes of this document, this factor is ignored.

Erlang tables

The table below summarizes the Grade of Service and the formula used in the traffic calculations. If the traffic model is non-blocking, then the Erlang-C formula would be used. For blocking calculations, the Erlang-B formula would be used.

Table 14-1: Grade of Service and traffic tables

Port type	Selection	GOS	Traffic formula	Table
Voice	ACD/PBX	P.05	Erlang-C	Table 14-2
Voice	UCD/CO	P.05	Erlang-C	Table 14-3
Voice	MLHG/Blocking CO	P.02	Erlang-B	Table 14-4
Fax	Call Back	P.05	Erlang-C	Table 14-5
Fax	Same Call	P.02	Erlang-B	Table 14-6

The following tables give the traffic intensity which can be supported by a given number of channels for a given average session length or hold time of the port. Where an Erlang-C table is indicated, the calculations are based on a 5% probability of delay of over one 6-second ring cycle. The results in an Erlang-C calculation depend only on the ratio of the tolerable delay to the total hold time. Thus, for an average session length of 120 seconds, this ratio would be 0.05. The ratio is indicated by *r* in the tables.

Table 14-2: Erlang-C traffic capacity (CCS) at P.05 for ACD/PBX

No. of ports	60 s sessions <i>r</i> = 0.1	120 s sessions <i>r</i> = 0.05	180 s sessions <i>r</i> = 0.03	300 s sessions <i>r</i> = 0.02
4	51.5	49.5	48.7	48.3
8	150.5	144.9	142.7	141.6
12	262.2	252.9	249.1	247.2
16	380.4	367.4	362.0	359.2
20	502.6	486.0	478.9	475.3
24	627.7	607.4	598.7	594.3

No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
28	754.9	731.1	720.8	715.5
32	883.8	856.5	844.5	838.3
36	1014.0	983.2	969.7	962.6
40	1145.4	1111.2	1096.0	1088.1
44	1277.6	1240.1	1223.4	1214.6
48	1410.7	1369.9	1351.6	1342.0
52	1544.5	1500.5	1480.6	1470.1
56	1678.9	1631.7	1610.2	1598.9
60	1813.8	1763.5	1740.5	1728.3
64	1949.2	1895.8	1871.3	1858.2
68	2085.0	2028.7	2002.5	1988.7
72	2221.2	2161.9	2134.3	2119.5
76	2357.8	2295.6	2266.4	2250.8
80	2494.7	2429.6	2398.9	2382.5
84	2631.9	2563.9	2531.8	2514.5
88	2769.4	2698.6	2665.0	2649.9
92	2907.1	2833.6	2798.0	2779.5
96	3045.0	2968.8	2932.2	2912.5
100	3183.2	3104.3	3066.3	3045.7
104	3321.6	3240.0	3200.6	3179.2
108	3460.1	3376.0	3335.1	3312.8
112	3598.9	3512.2	3469.8	3446.8
116	3737.8	3648.5	3604.8	3580.9
120	3876.9	3785.1	3739.9	3715.2

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No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
124	4016.1	3921.8	3875.2	3849.7
128	4155.4	4058.7	4010.7	3984.4
132	4294.9	4195.8	4146.4	4119.3
136	4434.5	4333.0	4282.3	4254.4
140	4574.2	4470.4	4418.2	4389.6
144	4714.1	4607.9	4554.4	4524.9
148	4854.0	4745.5	4690.7	4660.4
152	4994.1	4883.3	4827.1	4796.0
156	5134.2	5021.1	4963.6	4931.8
160	5274.5	5159.1	5100.3	5067.7
164	5414.8	5297.3	5237.1	5203.7
168	5555.2	5435.5	5374.0	5339.8
172	5695.7	5573.8	5511.0	5476.0
176	5836.3	5712.2	5648.2	5612.4
180	5976.9	5850.8	5785.4	5748.8
184	6117.6	5989.4	5922.7	5885.4
188	6258.4	6128.1	6060.2	6022.1
192	6399.3	6266.9	6197.7	6158.8
196	6540.2	6405.8	6335.3	6295.7
200	6681.2	6544.7	6473.0	6432.6
204	6822.2	6683.8	6610.8	6569.6
208	6963.3	6822.9	6748.7	6706.7
212	7104.4	6962.1	6886.6	6843.9
216	7245.6	7101.3	7024.6	6981.2

No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
220	7386.9	7240.7	7162.7	7118.6
224	7528.2	7380.1	7300.9	7256.0
228	7669.6	7519.5	7439.2	7393.5
232	7810.9	7659.1	7577.5	7531.1
236	7952.4	7798.6	7715.9	7668.7
240	8093.9	7938.3	7854.3	7806.4
244	8235.4	8078.0	7992.8	7944.2
248	8377.0	8217.8	8131.4	8082.0

Table 14-3: Erlang-C traffic capacity (CCS) at P.05 for UCD/MSM

No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
4	44.3	42.6	41.9	41.5
8	129.4	124.7	122.7	121.7
12	225.5	217.5	214.2	212.6
16	327.1	316.0	311.3	308.9
20	432.2	417.9	411.9	408.8
24	539.8	522.4	514.9	511.1
28	649.2	628.7	619.9	615.3
32	760.1	736.5	726.3	721.0
36	872.1	845.6	833.9	827.9
40	985.0	955.6	942.6	935.8
44	1098.8	1066.5	1052.1	1044.6

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No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
48	1213.2	1178.1	1162.4	1154.1
52	1328.3	1290.4	1273.3	1264.3
56	1443.8	1403.3	1384.8	1375.0
60	1559.9	1516.6	1496.8	1486.3
64	1676.3	1630.4	1609.3	1598.1
68	1793.1	1744.6	1722.2	1710.2
72	1910.3	1859.2	1835.5	1822.8
76	2027.7	1974.2	1949.1	1935.7
80	2145.4	2089.4	2063.1	2049.0
84	2263.4	2205.0	2177.3	2162.5
88	2381.7	2320.8	2291.9	2276.3
92	2500.1	2436.9	2406.7	2290.4
96	2618.7	2553.2	2521.7	2504.7
100	2737.6	2669.7	2637.0	2619.3
104	2856.6	2786.4	2752.5	2734.1
108	2975.7	2903.4	2868.2	2849.0
112	3095.0	3020.5	2984.0	2964.2
116	3214.5	3137.7	3100.1	3079.6
120	3334.1	3255.2	3216.3	3195.1
124	3453.8	3372.8	3332.7	3310.8
128	3573.7	3490.5	3449.2	3426.6
132	3693.6	3608.4	3565.9	3542.6
136	3813.7	3726.4	3682.7	3658.7
140	3933.8	3844.5	3799.7	3775.0

No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
144	4054.1	3962.8	3916.8	3891.4
148	4174.5	4081.1	4034.0	4007.9
152	4294.9	4199.6	4151.3	4124.6
156	4415.4	4318.2	4268.7	4241.3
160	4536.0	4436.9	4386.3	4358.2
164	4656.7	4555.6	4503.9	4475.2
168	4777.5	4674.5	4621.7	4592.2
172	4898.3	4793.5	4739.5	4709.4
176	5019.2	4912.5	4857.4	4826.7
180	5140.1	5031.7	4975.5	4944.0
184	5261.2	5150.9	5093.6	5061.5
188	5382.2	5270.2	5211.7	5179.0
192	5503.4	5389.5	5330.0	5296.6
196	5624.6	5509.0	5448.4	5414.3
200	5745.8	5628.5	5566.8	5532.0
204	5867.1	5748.0	5685.3	5649.9
208	5988.4	5867.7	5803.9	5767.8
212	6109.8	5987.4	5922.5	5885.8
216	6231.3	6107.2	6041.2	6003.8
220	6352.7	6227.0	6160.0	6122.0
224	6474.3	6346.9	6278.8	6240.1
228	6595.8	6466.8	6397.7	6358.4
232	6717.4	6586.8	6516.6	6476.7
236	6839.1	6706.8	6635.6	6595.1

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No. of ports	60 s sessions r = 0.1	120 s sessions r = 0.05	180 s sessions r = 0.03	300 s sessions r = 0.02
240	6960.7	6826.9	6754.7	6713.5
244	7082.5	6947.1	6873.8	6832.0
248	7204.2	7067.3	6993.0	6950.5

Table 14-4: Erlang-B traffic capacity (CCS) at P.02 CO/Blocking

Channels	4	8	12	16	20	24	28	32
Traffic (CCS)	39	131	238	354	475	599	725	854

Channels	36	40	44	48	52	56	60	64
Traffic (CCS)	39	131	238	354	475	599	725	854

Channels	68	72	76	80	84	88	92	96
Traffic (CCS)	984	2197	2335	2473	2611	2750	2889	3028

Channels	100	104	108	112	116	120	124	128
Traffic (CCS)	3167	3307	3446	3587	3727	3867	4008	4148

Channels	132	136	140	144	148	152	156	160
Traffic (CCS)	4289	4430	4571	4713	4854	4996	5137	5279

Channels	164	168	172	176	180	184	188	192
Traffic (CCS)	5421	5563	5705	5847	5989	6132	6274	6417

Channels	196	200	204	208	212	216	220	224
Traffic (CCS)	6559	6702	6844	6987	7130	7273	7416	7559

Channels	228	232	236	240	244	248
Traffic (CCS)	7702	7845	7988	8132	8275	8418

Fax on Demand (Call Back delivery)

The Fax Application traffic must be estimated and port requirements determined for the number of faxes requested in the busy hour. This is done by estimating the average session length for each Fax application defined and estimating the expected maximum number of busy hour calls to that application.

The traffic from a “Call Back” fax delivery should include the duration of the call to receive the request, and also the duration of the call that delivers the faxes. The call receiving the request consists of the following components:

- Time to listen to voice menus (15 seconds)
- Time to select options (10 seconds for each option selected)
- Time to enter call-back number and extension (30 seconds)

The session time for each fax delivery can be estimated as follows:

- 10 seconds to setup the call
- 14 seconds to answer the call
- 12 seconds to establish the protocol

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- 40 seconds per page in normal resolution and 80 seconds per page in fine resolution
- 10 seconds to complete the fax delivery

This assumes that the fax will be delivered on the first attempt. Additional time should be added if this is not the normal case.

Table 14-5: Fax GOS for P.05 Erlang-C

Fax ports	(CCS - P.05)
1	1.8
2	12.7
3	29.1
4	48.7
5	70.3
6	93.4
7	117.6
8	142.7
9	160.9
10	194.9
11	211.7
12	249.1
13	264.2
14	304.9
15	333.3
16	362.0
17	372.9
18	400.7
19	428.7

Fax ports	(CCS - P.05)
20	456.8
21	485.1
22	513.6
23	542.2
24	571.0
25	599.9
26	628.9
27	658.0
28	687.2
29	716.5
30	746.0
31	775.5
32	805.1
33	834.7
34	864.5
35	894.3
36	924.2
37	954.2
38	984.2
39	1014.3
40	1044.5
41	1074.7
42	1105.0
43	1135.3

Fax ports	(CCS - P.05)
44	1165.7
45	1196.1
46	1226.6
47	1257.2
48	1287.7

When the application is running, the fax delivery report can be periodically monitored to see if the actual wait times are within the desired limits.

Fax on Demand (Same Call delivery)

The Voice Menu traffic must be estimated and port requirements determined for the number of faxes requested in the busy hour. This is done by estimating the average session length for each menu defined, estimating the number of pages in the fax to be delivered, and estimating the expected maximum number of busy hour calls to that menu.

The traffic from a “Same Call” fax delivery call should include the following components:

- Time to listen to the greeting prompt
- Time to listen to the voice menus and select as many faxes as required
- Time to receive “same call” faxing instructions
- Time to transmit the faxes selected, including:
 - 12 seconds to establish the protocol.
 - 40 seconds per page in normal resolution and 80 seconds per page in fine resolution.
 - 10 seconds to complete the fax delivery.

Tables have been generated for fax session lengths of 234 seconds¹ (3.9 minutes). The tables indicate the traffic which can be handled by a given number of fax ports.

Table 14-6: Fax GOS for P.02 Erlang-B

Fax ports	(CCS - P.05)
2	8
3	21.5
4	38.9
5	59.1
6	81.1
7	104.6
8	129.3
10	181.2
12	235.7

-
1. An analysis was done for fax session length and number of pages in each fax at the TOR site (for MM9). The average session length was 234 seconds and the average number of pages in each fax was 4.8. These figures were considered a useful starting point for the fax traffic tables.

Chapter 15: System sizing

Estimating the required number of ports

To determine the system requirements for IVR, it is very important to analyze the customer's specific applications. IVR can vary widely in terms of calls requiring processing and the holding times of those calls.

To ensure the IVR system provides adequate capacity, follow these steps for each IVR application:

- 1 Estimate the average length of a call in seconds. An average holding time for a short IVR application may be 30 seconds, while a lengthy IVR application may be 300 seconds.
- 2 Estimate the number of calls per busy hour.
- 3 Estimate total activity for IVR by multiplying the Step 1 estimate by the Step 2 estimate and dividing by 100 for each planned application.
- 4 To determine the fewest number of ports required to accommodate the total activity for the system, use the number from Step 3 and refer to the traffic capacity tables in Chapter 14 to find the number that best accommodates the total activity calculated above, given the grade of service required.

Example:

A customer has three IVR applications. The main IVR application (IVR_MAIN) answers all calls to the company. The customer has two other IVR applications: IVR_CHILD_1 and IVR_CHILD_2. The average delay for callers must not exceed one second and no more than 5% of callers should encounter a delay in the busy hour (equates to a 5% delay Grade of Service).

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Table 15-1: Example Table for GOS P.05

Procedure	Step 1	X Step 2	= Step 3
Application	Calls in Busy Hour	X Holding Time (seconds)	Total Time (seconds)
IVR_MAIN	200	X 20	4000
IVR_CHILD_1	10	X 240	2400
IVR_CHILD_2	30	X 180	5400
Total Time			11,800 seconds or 118 CCS

Total system activity for all IVR applications is 118 CCS. Look up the total CCS value in Table 14-2 or Table 14-3 (depending on your switch type) to find the number of ports required to achieve the recommended grade of service. For 118 CCS, the total port requirements are eight ports for IVR connected to an ACD/PBX or UCD/MSM switch.

Fax example:

A customer has four IVR applications. The main IVR application (IVR_MAIN) answers all calls to the company and walks the caller through a fax menu. The customer has three other IVR fax applications: IVR_Fax_1, IVR_Fax_2 and IVR_Fax_3. The typical session duration for IVR_MAIN menu is 45 seconds (time to listen to voice menu, plus time to select option, and time to enter call-back number if required). IVR_Fax_1 is 214 seconds (4.8 pages of fax in standard resolution). IVR_Fax_2 is 480 seconds (6 pages in fine resolution). IVR_Fax_3 is 382 seconds (3 pages). For simplicity let's assume that IVR_Fax_1 and IVR_Fax2 will use Call Back channels and IVR_Fax_3 will use Same Call channels.

IVR_Fax_1 Holding Time = 25 s (fax menu) + 10 s (time to set up call) + 14 s (to answer call) + 12 s (to establish protocol) + 10 s (to complete fax delivery) + 4.8 (pages) * 40 s (for standard format) = 263 s

IVR_Fax_2 Holding Time = 25 s (fax menu) + 10 s (time to set up call) + 14 s (to answer call) + 12 s (to establish protocol) + 10 s (to complete fax delivery) + 3 (pages) * 80 s (for fine format) = 311 s

IVR_Fax_3 Holding Time = 55 s (fax menu) + 12 s (to establish protocol) + 10 s (to complete fax delivery) + 3 (pages) * 40 s (for standard format) = 197 s

Table 15-2: Example Table for GOS P.05 and P.02

Procedure	Step 1	X Step 2	= Step 3
Application	Calls in Busy Hour	X Holding Time (seconds)	Total Time (seconds)
IVR_MAIN	30		
IVR_Fax_1 (Call Back)	10	X (25 + 10 + 14 + 12 + 10 + (4.8 * 40))	2630
IVR_Fax_2 (Call Back)	10	X (25 + 10 + 14 + 12 + 10 + (3 * 80))	3110
IVR_Fax_3 (Same Call)	10	X (55 + 12 + 10 + (3 * 40))	1970
Total Time for P.05 (Call Back)			5,740 seconds 57 CCS
Total Time for P.02 (Same Call)			1,970 seconds 20 ccs

Total system activity is 57 CCS for all Call-Back IVR Fax applications, and 20 CCS for all Same-Call Fax applications. Look up the total CCS values in Table 14-5 and Table 14-6 to find the number of ports required to achieve the recommended grade of service. Using this example, total port requirements are five ports for Call-Back Fax and three ports for Same-Call Fax.

When the use of call-back channels is high in certain hours and may exceed the limit where the use of same-call channels is low, it is a good idea to turn some of the same-call channels into shared channels or vice versa.

Sharing channels amongst IVR applications

This is another option where the application to be executed is dependent upon the ANI (or called number). All 96 IVR channels may be shared amongst IVR applications.

Outcalling applications

An IVR application may use the outcalling feature. Depending on the numbers and length of these calls, a number of outcalling channels must be configured. The number is determined in exactly the same way although the GOS can be lax depending on the application (a machine is calling now and it can try again if it is blocked). These channels may *not* be used for incoming calls.

Database servers and host sessions

There can be a maximum of 50 simultaneous RDBMS accesses, 64 3270 SNA/5250 sessions, and 16 VT100 sessions on the MRS/AP (32 VT100 sessions on the AP). The numbers of these are dependent on the access time to the database or host. If the total call time is T seconds and that of the SQL or host access time is a total of t seconds, then one SQL server or one host session can support T/t channels of that application. However, a safety margin should be applied and each server or host session should support only $T/2t$ channels.

For example, say a 64-channel system is used and each call lasts 100 seconds. If that total host access time for the entire call is 10 seconds, then each 3270 session can support 5 channels. Thus 64 channels would need $64/5$ or 13 sessions.

Memory sizing

This section will highlight under which conditions (installing different features) different memory configuration should be used.

The following example illustrates how memory sizing should be implemented.

Example:

A customer will require the following feature set for an MRS/AP:

- 24 ports of IVR
- Fax Option with 4 ports
- UPS option

Memory requirements calculation:

- 1 Add the core software memory usage for IVR: 211 points
- 2 Add the channel points for IVR:
 $1 \text{ (per IVR channels)} * 24 \text{ (required channels)} + 2 \text{ (required fax channels)}$
 $= 26$
- 3 Check the UPS requirement: 21 points
- 4 Add all of the above calculated points:
 $211 + 26 + 21 = 258$
- 5 Compare the calculated points with the available points for 32, 64, or 96 Mbyte system memory. In this case we can use a 32 Mbyte system since it gives us enough memory (total available memory points is 298).

Note: See “Memory requirements for base processes” in Chapter 8.

Table 15-3: Scenario table for AP Memory and CPU requirements

	Customer requires the following features	Memory required
Scenario 1	- UPS Option - 3270 SDLC, 8 sessions	32 Mbyte
Scenario 2	- UPS Option - ADSI Option - 3270 SDLC, 32 sessions	32 Mbyte
Scenario 3	- UPS Option - Fully Installed Local Oracle database (Approximation, 10 Mbyte of DRAM usage)	32 Mbyte
Scenario 4	- Fully Installed Local Oracle database (Approximation, 10 Mbyte of DRAM usage) - 3270 SDLC, 32 sessions - UPS Option - ADSI Option	32 Mbyte

Table 15-4: Scenario table for MRS/AP Memory and CPU requirements

	Customer requires the following features	Memory required
Scenario 1	-8 IVR Channels - UPS Option	32 Mbyte
Scenario 2	- 12 IVR Channels - 4 Fax ports - Voice Recognition Option	32 Mbyte
Scenario 3	- 24 IVR Channels - T1 Option - 8 Fax ports - 3270 SDLC, 24 sessions - UPS Option	48 Mbyte
Scenario 4	- 30 IVR Channels - UPS Option - E1 Option - Fully Installed Local Oracle database (Approximation, 10 Mbyte of DRAM usage)	48 Mbyte
Scenario 5	- 24 IVR Channels - UPS Option - T1 Option - ADSI Option - Text-To-Speech Option - 5250 SDLC, 18 sessions - Fully Installed Local Oracle database (Approximation, 10 Mbyte of DRAM usage)	48 Mbyte

15-8 System sizing

	Customer requires the following features	Memory required
Scenario 6	- 24 IVR Channels - UPS Option - T1 Option - 8 Fax ports - ADSI Option - Voice Recognition Option - 5250 SDLC, 32 sessions - Fully Installed Local Oracle database (Approximation, 10 Mbyte of DRAM usage)	48 Mbyte

CPU sizing

For MRS/AP, a 100 MHz Pentium processor is sufficient for all configurations. For AP, a 75 MHz Pentium processor is sufficient.

Disk sizing

The hard disk space required for different Nortel IVR 2.5/S options is discussed in Chapter 8. For additional information regarding third parties software disk space requirements (for example, Oracle, Informix), please consult their appropriate documentation.

The disk partition tables shown in Chapter 8 for the MRS and MRS/AP indicate the VSN volume sizes in Mbyte. Sometimes it is useful to know the storage capacity of a VSN volume in hours rather than Mbyte. To convert Mbyte into hours, the following formula should be used:

$$\text{storage [hours]} = \frac{\text{storage [Mbyte]} \times 8 \text{ bits/byte} \times 1000 \text{ kbyte/Mbyte}}{\text{sampling rate [kbit/s]} \times 3600 \text{ s/hour}}$$

For example, if a VSN volume has a size of 442 Mbyte, and the sampling rate is 32 kbit/s, the storage capacity in hours can be calculated as follows:

$$\text{storage} = \frac{442 \text{ Mbyte} \times 8 \times 1000}{32 \text{ kbit/s} \times 3600 \text{ s/hour}} = 30.69 \text{ hours}$$

Appendix A: List of terms

10BASE2

Ethernet running on Thinwire network cable.

10BASE5

Ethernet running on Thickwire network cable.

10BASE-T

Ethernet running on Unshielded Twisted Pair (UTP) cable. Note that 10BASE-T is a point-to-point network media, with one end of the cable typically going to a repeater/hub and the other to the network device.

Acoustic Coupler

A device (such as the Audio Interface Unit) used to interface between sound equipment and a port on an MRS.

ACD

Automatic Call Distribution. System for distributing incoming calls to groups of answering positions while efficiently managing system resources.

ADSI

Analog Display Services Interface. ADSI is an in-band signaling protocol developed by Bellcore for interface to display-based telephones thereby programming the phone's softkeys and allowing the user to respond to screen information sent by the IVR system.

ANI (Automatic Number Identification)

Protocol implemented in some trunk cards that records the calling number.

API

Application Programming Interface. High level language software used as components in the development of an application.

AppleTalk

A communications protocol developed by Apple Computer to allow networking between Macintoshes. All Macintosh computers have a LocalTalk port, running AppleTalk over a 230 kbit serial line. AppleTalk also runs over Ethernet (EtherTalk) and Token Ring (TokenTalk) network media.

Application

A customized program that controls activity on one or more telephone trunks connected to an MRS.

Application Editor

Used to graphically create or edit interactive voice response applications.

AUI

Attachment Unit Interface. A 15-pin shielded, twisted pair Ethernet cable used (optionally) to connect between network devices and a MAU.

Backbone

The main cable in a network.

Baseband LAN

A LAN that uses a single carrier frequency over a single channel. Ethernet, Token Ring and Arcnet LANs use baseband transmission.

BNC

A standardized connector used with Thinnet and coaxial cable.

Branch

A pathway from one cell in an application to the next cell.

Bridge

A networking device that connects two LANs and forwards or filters data packets between them, based on their destination addresses. The two LANs must be of the same access method, e.g., Ethernet to Ethernet or Token Ring to Token Ring. Bridges operate at the data link level (layer 2) (or MAC-layer) of the OSI reference model, and are transparent to protocols and to higher level devices like routers.

Router

A device that routes specific protocols, such as TCP/IP and IPX, and bridges other protocols, thereby combining the functions of both routers and bridges.

Buffers

Used to store information from one cell and pass it to another cell.

Bus

A LAN topology in which all the nodes are connected to a single cable. All nodes are considered equal and receive all transmissions on the medium.

Call ID

Unique Call Identifier. Unique identifier assigned to a call by the Meridian-1, and maintained throughout the entire duration of the call.

CAS

Channel Associated Signalling

CAT

Channel Allocation Table

Cell

The basic building block of a GENERATIONS application which performs high level action and then branches to another cell based on the outcome of that action.

CLID

Calling Line ID. An ISDN service, CLID identifies the calling party. It is passed to the PBX when the CO routes a call over PRA to the PBX. CLID is typically the 10 digit telephone number of the caller.

Client

A client is the workstation or PC which makes a request of the server.

CO

Central Office.

Coaxial Cable

An electrical cable with a wire conductor at its center surrounded by insulating materials and an outer metal screen conductor with an axis of curvature coinciding with the inner conductor - hence “coaxial”. Examples are standard Ethernet cable and ThinWire Ethernet cable.

Collision

The result of two network nodes transmitting on the same channel at the same time. The transmitted data is not usable.

Collision Detect

A signal indicating that one or more stations are contending with the local station's transmission. The signal is sent by the Physical layer to the Data Link layer on an Ethernet/IEEE 802.3 node.

CSL

Command and Status Link.

CSMA/CD

Carrier Sense Multiple Access with Collision Detection is the Ethernet media access method. All network devices contend equally for access to transmit. If a device detects another device's signal while it is transmitting, it aborts transmission and retries after waiting a very brief pause.

Data Link Layer

Layer 2 of the seven-layer OSI reference model for communication between computers on networks. This layer defines protocols for data packets and how they are transmitted to and from each network device. It is a medium-independent, link-level communications facility on top of the Physical layer, and is divided into two sublayers: medium-access control (MAC) and logical-link control (LLC).

DECnet

Digital Equipment Corporation (DEC) proprietary network architecture, a system for networking computers. It runs on point-to-point, X.25 and Ethernet networks.

DN

Directory Number.

DNIS

Directory Number Identification System. A service provided on a trunk. DNIS identifies to the called system the last 3 or 4 digits of the number actually dialed by the caller. The DNIS digits are sent as in-band DTMF tones on non-ISDN trunks, or using dial pulses on dial pulse (DIP) trunks. On ISDN PRA trunks, DNIS is carried in the called party IE field of the Q.931 setup message.

Domain

A domain is a logical grouping of users and servers in which users are given access to the resources they need to do their jobs.

Drop Cable

The cable connecting an external transceiver to the AUI connector on the NIC. The AUI cable is called a “drop cable” because sometimes they “drop” from the ceiling where the backbone LAN cable is running.

DSP

Digital Signal Processor.

DTMF (Dual Tone Multi Frequency)

Term that describes Touchtone (push button) dialing. Applications can collect information from callers by having them press telephone keys to create DTMF tones.

Ethernet

The most popular LAN technology in use today. The IEEE standard 802.3 defines the rules for configuring an Ethernet network. It is a 10 Mbit/s, CSMA/CD baseband network that runs over thin coax, thick coax, twisted-pair or fiber-optic cable.

EtherTalk

Apple Computer's protocol for Ethernet transmissions.

Extended LAN

A network consisting of LANs connected by bridges. Up to seven bridges can connect LANs into an extended LAN.

FDDI

Fiber optic Data Distribution Interface. A cable interface capable of transmitting data at 100 Mbit/s. Originally specified for fiber lines, FDDI can also operate over twisted-pair cable for short distances.

Fiber-Optic Cable

A transmission medium composed of a central glass or plastic optical fiber cable surrounded by cladding and an outer protective sheath. It transmits digital signals in the form of modulated light from a laser or LED (light-emitting diode).

FTP

File Transfer Protocol, a TCP/IP protocol for file transfer.

Gateway

A device for interconnecting two or more dissimilar networks. It can translate all protocol levels from the Physical layer up through the Applications layer of the OSI model, and can therefore interconnect entities that differ in all details.

Generations

The voice application development and management software package incorporated into Nortel IVR 2.5/S.

GOS

Grade Of Service

IEEE

Institute of Electrical and Electronic Engineers.

IEEE 802.3

The IEEE standard that defines the CSMA/CD media-access method and the physical and data link layer specifications of a local area network. Among others, it includes 10BASE2, 10BASE5, 10BASE-FL and 10BASE-T Ethernet implementations.

IEEE 802.5

The IEEE standard that defines the Token Passing media-access method.

I/O Address

The I/O address or Input/Output Address is the starting memory address through which the CPU exchanges data with peripheral devices such as floppy drives, SCSI devices, COM ports (tty's) and other. It is important to notice that no devices should share the same I/O address in memory.

IPX

Internetwork Packet eXchange, a NetWare protocol similar to IP (Internet Protocol). This is a communication protocol that creates, maintains, and terminates connections between network devices, such as workstations and servers. Dedicated IPX drivers combine the IPX protocol with a MAC-level driver into one executable piece of code. IPX cannot be uploaded from memory, supports only a single adapter, and does not support multiple protocols.

IRQ

Interrupt ReQuests (IRQs) are used in Nortel IVR products. They are the way a device signals the data bus and the CPU that it needs attention. In other words, an IRQ is a signal sent to the central processing unit (CPU) to temporarily suspend normal processing and transfer control to an interrupt handling routine. Interrupts may be generated by conditions such as completion of an I/O process, detection of hardware failure, etc.

ISO Layered Model

The International Standards Organization (ISO) sets standards for computers and communications. Its Open Systems Interconnection (OSI) reference model specifies how dissimilar computing devices such as Network Interface Cards (NICs), bridges and routers exchange data over a network.

IVR

Interactive Voice Response allows the caller to interact with on-line host computers and databases. Possible caller actions include entering a PIN number on the touch-tone keypad and hearing the current balance of your bank account.

Jabber

Network error caused by an interface card placing corrupted data on the network. Or, an error condition due to an Ethernet node transmitting longer packets than allowed. Jabber control is built into the transceivers to ensure that a single station does not transmit for more than 150 milliseconds.

Keylock

Hardware security device.

Key code

Serial number used during system software installation to load the customer ordered options.

LAN

Local Area Network, a data communications system consisting of a group of interconnected computers, sharing applications, data and peripherals. The geographical area is usually a building or group of buildings.

LocalTalk

Apple Computer's proprietary 230 kbit/s baseband network protocol. It uses the CSMA/CD access method over unshielded twisted-pair wire.

Loopstart

Method to start (seize) a phone line or trunk by giving it a supervisory signal (done by taking it off the hook). Loopstart seizes the line by bridging through the resistance of the tip and ring wires of the telephone line, which starts the dial tone. Normally used for single lines or key systems.

MAU

Medium Attachment Unit, a device used to convert signals from one Ethernet medium to another. The same acronym stands for Multiple Access Unit (MAU) in a Token Ring network and connects stations to the ring via this switching device.

Meridian 1

A telephone switch (owned usually by a larger organization or company) that allows efficient routing of calls among all the telephone sets connected to it. Of course, these switches are also connected to a public CO (in order to have access to a public telephone network). But they can also be connected directly to other Meridian 1s (in order to be a part of a private telephone network)

MLHG

Multi-Line Group

MRS

MultiMedia Resources Server. This term refers to the MRS/Tower and MRS/Rack platforms, as well as the software which enables applications on the Application Processor to access MRS resources.

MSM

Message Service Module. High end Meridian Mail platform for DMS/SL-100 switches.

Multiport Repeater

A repeater, either stand-alone or connected to standard Ethernet cable, for interconnecting up to eight ThinWire Ethernet segments.

NetBEUI (NetBIOS Extended User Interface)

NetBEUI is the protocol most commonly used by LAN Manager to connect the user workstations with the server and with each other. This is the protocol that the LAN Manager installation procedures will install by default, and it is the protocol that Windows for Workgroups uses. NetBEUI extends NetBIOS to a full networking protocol with additional features and services. It is important to note that NetBEUI is designed to be run on a single physical local area network. Unlike Novell's IPX protocol and the standard TCP/IP protocol, NetBEUI is difficult to route across multiple physical network segments.

NetBIOS (Network Basic Input Output System)

The Network Basic Input/Output System is an example of a popular high-level API designed to enable developers to use IBM's PC Network to build network applications. NetBIOS is not really a protocol, it is an interface to a set of commands that enables network applications to perform the following functions: Establish communications sessions between applications, Send and receive data, and Name objects on the network. Examined in the context of the OSI Reference Model, NetBIOS appears at the session layer. If your application requests to drive E, for example, and E has been redirected to a network, NetBIOS intercepts the disk-access and redirects it over the network.

NetWare

A Novell-developed Network Operating System (NOS). Provides file and printer sharing among networks of PC's. Each NetWare network must have at least one file server, and access to other resources is dependent on connecting to and logging into the file server. The file server(s) control user logins and access to other network clients, such as user PC's, printer servers, modem/fax servers, disk/file servers, etc.

Network

An interconnected system of computers that can communicate with each other and share files, data and resources.

Network Address

Every node on an Ethernet has one or more addresses associated with it, including at least one fixed hardware address assigned by the device's manufacturer. Most nodes also have protocol specific addresses assigned by a network manager.

Network Management

Administrative services for managing a network, including configuring and tuning, maintaining network operation, monitoring network performance, and diagnosing network problems.

NIC

Network Interface Card, an adapter card that is inserted into a computer, and contains the necessary software and electronics to enable the station to communicate over the network.

Node

Any intelligent device connected to the network. This includes terminal servers, host computers, and any other devices (such as printers and terminals) that are directly connected to the network. A node can be thought of as any device that has a "hardware address."

NOS

Network Operating System, the software for a network that runs in a file server and controls access to files and other resources from multiple users. It can run on top of DOS, and also provides security and administrative tools. Novell's NetWare, Banyan's VINES and IBM's LAN Server are NOS examples.

NTP

Northern Telecom Practice. System documentation.

Open System Interconnect (OSI)

A seven-layer model developed by the ISO that governs community interchange between systems. The model is an internationally accepted framework of standards for intersystem communications.

Packet

A series of bits containing data and control information, including source and destination node addresses, formatted for transmission from one node to another.

PCI

Peripheral Component Interconnect.

PEB

PCM Expansion Bus.

Physical Address

An address identifying a single node.

Physical Layer

Layer 1, the lowest layer of the OSI model, is implemented by the physical channel. The Physical layer insulates Layer 2, the Data Link layer, from medium-dependent physical characteristics such as baseband, broadband or fiber-optic transmission. Layer 1 defines the protocols that govern transmission media and signals.

POST

Power On Self Test.

RAID

Redundant Array of Inexpensive Disks.

RAM terms:

- **BEDO** Burst extended data out RAM requires zero wait states to read or write. This increases uncached system efficiency by roughly 13 percent on a 66 MHz 486 PC, and more on Pentium-class computers.
- **Cache RAM** This high-speed SRAM is dedicated to storing information most likely to be required by the CPU, and is often present in 64 kbyte, 128 kbyte, 256 kbyte or 512 kbyte capacities.
- **DIMM** This dual in-line memory module is an emerging form factor with 2 banks of RAM chips soldered to a single circuit board. A DIMM resembles a SIMM, but delivers twice the storage capacity.
- **DRAM** Dynamic RAM is the most common form of computer memory. These are the chips found on most SIMM modules. When we say “memory,” we mean DRAM. DRAM is rated in terms of storage capacity (in Mbyte) and access time (in nanoseconds). A 60 ns DRAM requires 60 billionths of a second, and 2 CPU wait states to save or return information.
- **EDO** Think of extended data out RAM as fast DRAM. EDO RAM requires only one wait state, and 60 ns, for read/write operations. Conventional DRAM requires 2 CPU wait states with access times of 60 ns to 80 ns. EDO RAM delivers 10 to 13 percent performance gains on systems with less than 256 kbyte of Level 2 cache.
- **Flash RAM** PDAs, PCMCIA cards and flash BIOS setup programs employ this high-speed nonvolatile memory. Flash RAM requires only a trickle of electrical power to retain memory contents over extended periods of time.

- **Shadow RAM** This portion of conventional RAM stores setup and video BIOS code. Moving BIOS code from slow ROM to fast RAM turbocharges PC performance.
- **SIMM** Single in-line memory modules are the prevailing industry-standard RAM form factor. SIMMs consist of a row of RAM chips soldered to a circuit board, and provide a complete memory upgrade on a single card.
- **SRAM** Static RAM is similar to DRAM, but it retains memory contents without refreshing. SRAM is faster and more expensive than DRAM and is generally used for CPU cache memory.
- **VRAM** Conventional DRAM chips allow one read or write operation at a time. Video RAM supports simultaneous read/write, read/read and write/write operations. It's most often used in graphics accelerators.

RDBMS

Relational Database Management System

Repeater

A repeater is a network device that repeats signals from one cable onto one or more other cables, while restoring signal timing and waveforms.

Ring

A network topology in which the nodes are connected in a closed loop. Data is transmitted from node to node around the loop, always in the same direction.

RJ14

A RJ11 jack with 2 lines on it instead of 1.

Router

Routers connect networks at the network layer (Layer 3) of the OSI model. Routers can be used to connect networks using different network protocols (i.e. ethernet to token ring, token ring to ARCnet, ethernet to LocalTalk).

RSM

RS-232 Service module. The card and cabling product in the Meridian 1 which provides four RS-232 ports and alarm capabilities.

Server

Network Operating Systems (NOS) run on computers called servers. Servers run special programs that accept a request from a user on a workstation (client), perform the task, and return the result.

SNA

Systems Network Architecture. This defines the protocols which govern communications among nodes in an SNA network. SNA is concerned with enabling reliable transfer of data among the end users in the network. It also contains protocols for controlling the resources of the network.

SPX

Sequential Packet eXchange. Novell's implementation of SPP (Sequential Packet Protocol).

SQE

Ethernet-defined signal quality test function, frequently called "heartbeat."

SQL

Structured Query Language - a standard language used to form queries to access information in a relational database.

T-Connector

A T-shaped device with two female and one male BNC connectors.

Tap

Usually refers to a point on the network backbone where other devices can be attached. Taps may be of several types, including simple "T" connectors or "Vampire" taps that attach directly to a network cable.

TCP/IP

Transmission Control Protocol (TCP) and Internet Protocol (IP) are the standard network protocols in UNIX environments. They are almost always implemented and used together and called TCP/IP.

Terminator

Used on both ends of a standard Ethernet or ThinWire Ethernet segment, this special connector provides the 50 ohm termination resistance needed for the cable.

Thickwire

Half-inch diameter coax cable.

Thinwire

Thin coaxial cable similar to that used for television/video hookups.

Token

The character sequence or frame, passed in sequence from node to node, to indicate that the node controlling it has the right to transmit for a given amount of time.

Token Ring

Developed by IBM, this 4 or 16 Mbit/s network uses a ring topology and a token-passing access method.

Topology

The arrangement of the nodes and connecting hardware that comprises the network. Types include ring, bus, star and tree.

Transceiver

External transceivers connect the node to the network via an AUI cable, commonly called a “drop cable.” Ethernet adapter cards with a BNC or RJ-45 connector have internal transceivers and therefore, do not require an AUI cable.

Transceiver cable

Cable that attaches a device either to a standard or ThinWire Ethernet segment.

TRS

Terminal Resource Server; manages the assignment of system resources to the Gateway products.

Twisted-Pair cable

Inexpensive, multiple-conductor cable comprised of one or more pairs of 18 to 24 gauge copper strands. The strands are twisted to improve protection against electromagnetic and radio frequency interference. The cable, which may be either shielded or unshielded, is used in low-speed communications, such as telephone cable. It is used only in baseband networks because of its narrow bandwidth.

UTP

Unshielded Twisted-Pair, one or more cable pairs surrounded by insulation. UTP is commonly used as telephone wire.

VSN (Voice Storage Number)

Internal numbering system used for prompts, messages, and faxes (if the fax option is installed) used by the MRSs. IVR Generator uses its own numbering system.

Wink

A momentary interruption in single frequency tone that indicates the distant central office is ready to receive the digits that were just dialed.

WAN

Wide Area Network, using common carrier transmission services for transmission of data over a large geographical area.

XAE

Generations Graphical Applications Editor

XPM

Prompt Manager. Used to graphically edit prompts.

Nortel IVR 2.5/S

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